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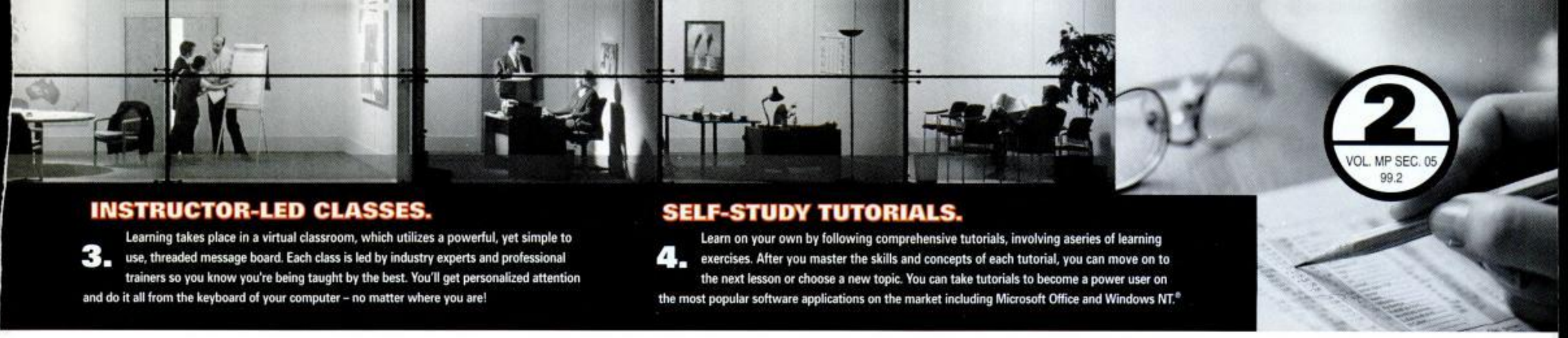

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RAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	8.4GB Ultra ATA hard drive*	8.4GB Ultra ATA hard drive*	10GB Ultra ATA hard drive*	13.5GB Ultra ATA hard drive*	13.5GB 7200RPM Ultra ATA hard drive*
Monitor	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)	15" Micron LCD display flat panel
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Graphics	nVidia Riva 128, 8MB SGRAM 3D 2X AGP graphics	nVidia Riva 128, 8MB SGRAM 3D 2X AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics
Sound System	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 128-voice Wavetable sound	PCI 128-voice Wavetable sound	PCI 128-voice Wavetable sound
Speakers	Advent AV009 stereo speakers	Advent AV009 stereo speakers	Advent AV009 stereo speakers	Monsoon MM1000 3-piece flat panel speaker system	Monsoon MM1000 3-piece flat panel speaker system
Warranty	5-year/3-year Micron Power™ limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty
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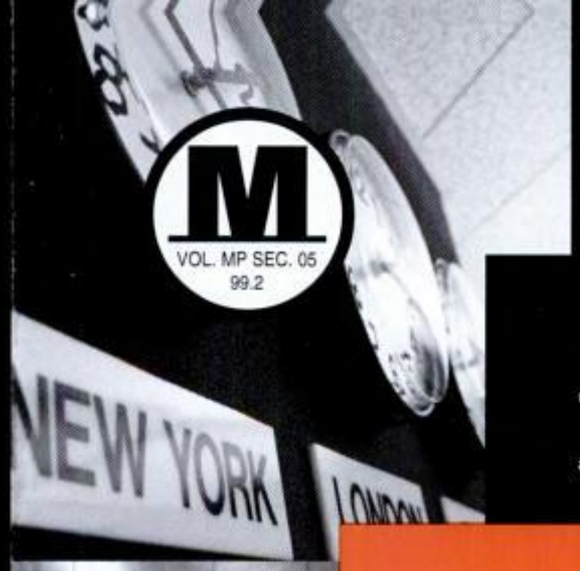

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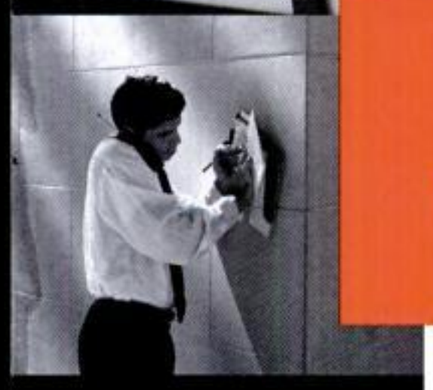

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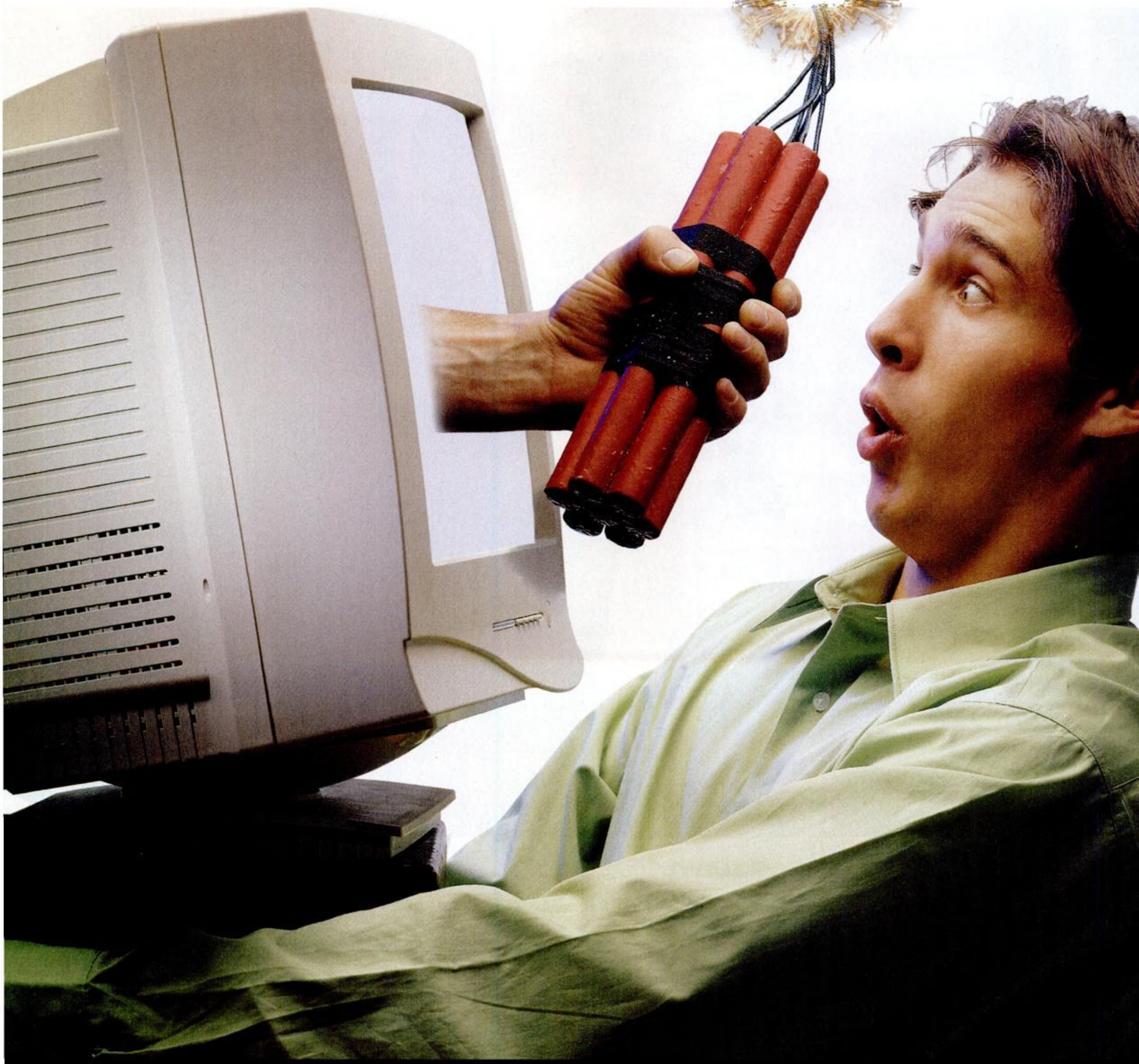

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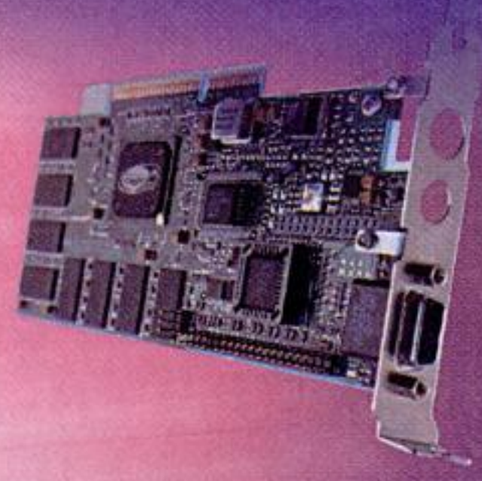

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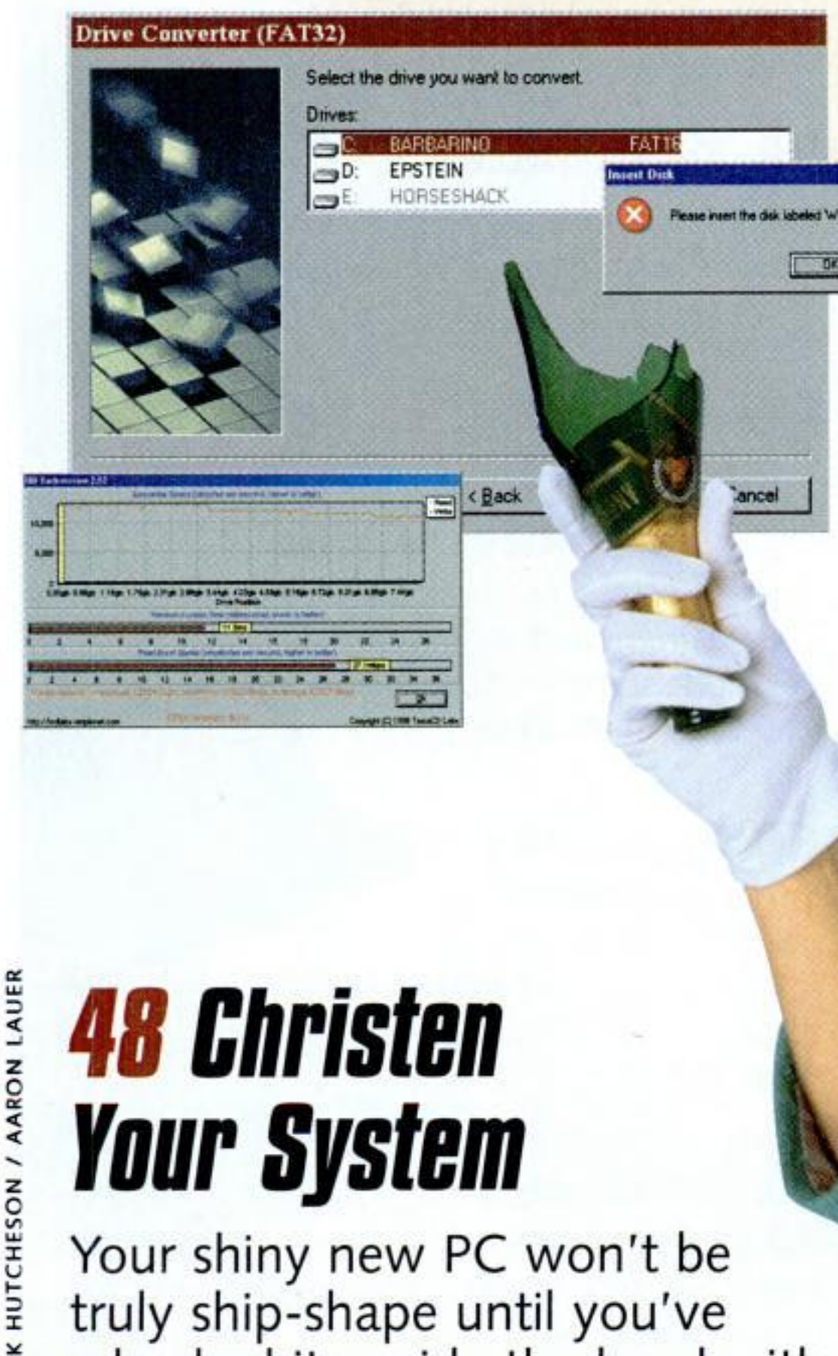
MAXIMUM PC

FEBRUARY 1999

48 Interrogation: SGI's Tom Furlong

Silicon Graphics is revving up to build the fastest PCs on the planet, with graphics power and memory bandwidth to burn. Speed freak **Tom Furlong** explains why SGI's rapid movement away from proprietary technology isn't the stuff of comic-book fantasies.



48 Christen Your System

Your shiny new PC won't be truly ship-shape until you've whacked it upside the head with a bottle full of kick-ass. So follow our 30 system-christening performance tips to maximize your machine's speed potential, prepare it for future expansion, and make it easier to use. Hardcore projects for hardcore tweakers.

COVER PHOTOGRAPHY BY JACK HUTCHESON / AARON LAUER

TOM'S HARDWARE GUIDE 06

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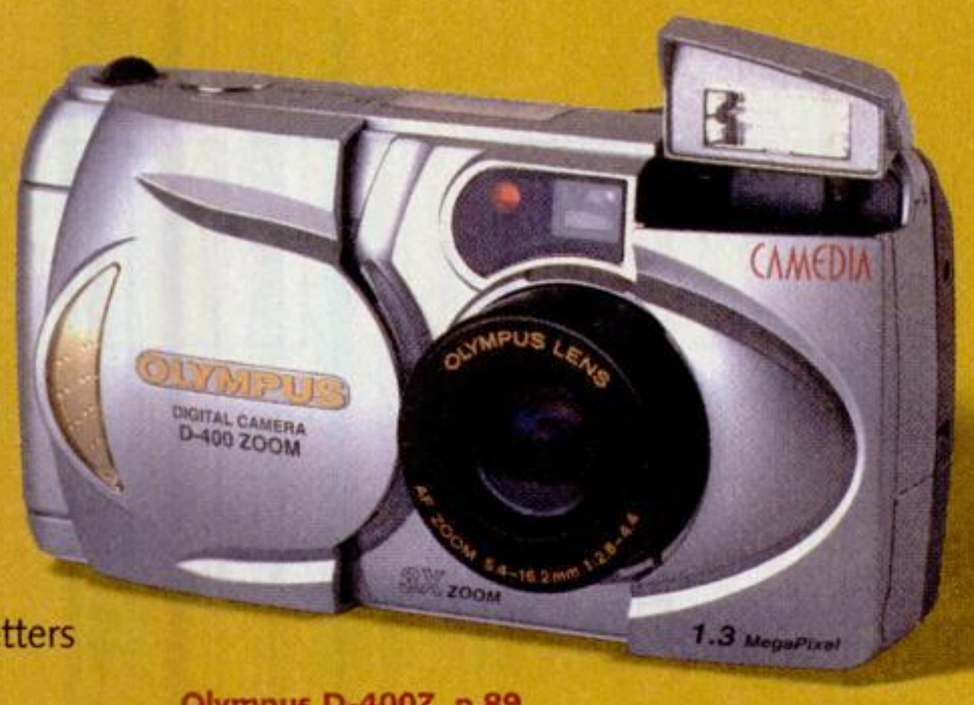

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You know those underlined words strewn about the magazine? We explain them here.

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Intel's new **Katmai** processor looks like it'll fall short of its full potential. Also: ATI's new **Rage 128** chipset.

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73 Reviews
We take the hottest new hardware and software, and test it until it smokes like a Fourth of July barbecue.

▶ Highlights inlclude: a 450MHz **desktop dragster** from Compaq, **videocards** from Hercules, Metabyte, and Matrox, two **CD-R drives** from HP and Sony, and **high-end speakers** from S2 and Advent. On the gaming tip, we have the first-person excursions **Half-Life**, **Blood II**, **SiN**, and **Thief: The Dark Project**. Apps include **finance aids**, and **music-creation software**.

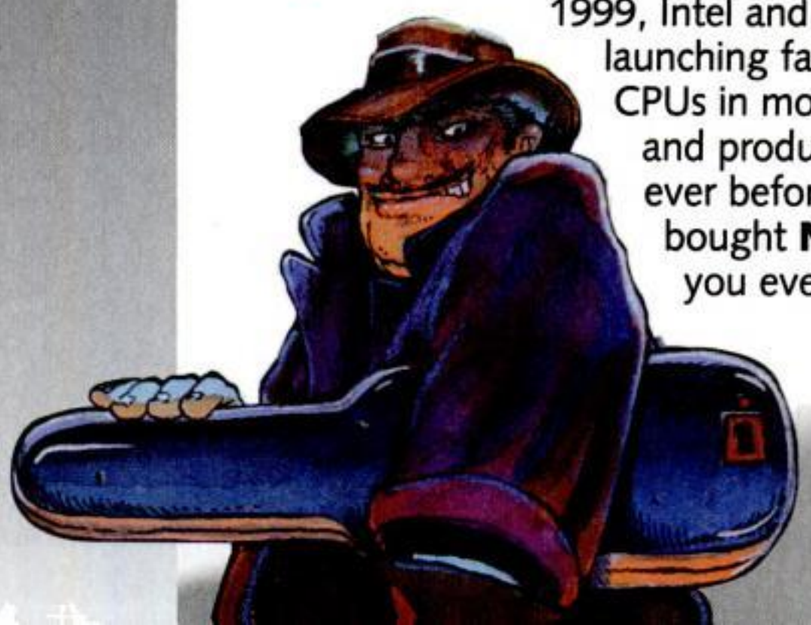
▶ NEWS

22 Inside Sources

News you need to win the tech race

One-by-one, players in the removable storage game have fallen like dead Corleones. In fact, only **Iomega** has avoided the fishy fate of **Syquest**, **Nomai**, and **Avatar**. Were these companies whacked by stronger players, or did they simply whack themselves? We give you The ATAPI Papers.

▶ **Also:** The **Mobile Processor Report**. In 1999, Intel and AMD will be launching faster mobile CPUs in more configurations and product families than ever before... And: **AOL** bought **Netscape**—do you even need to care?



Iomega: Last man Standing, p.22

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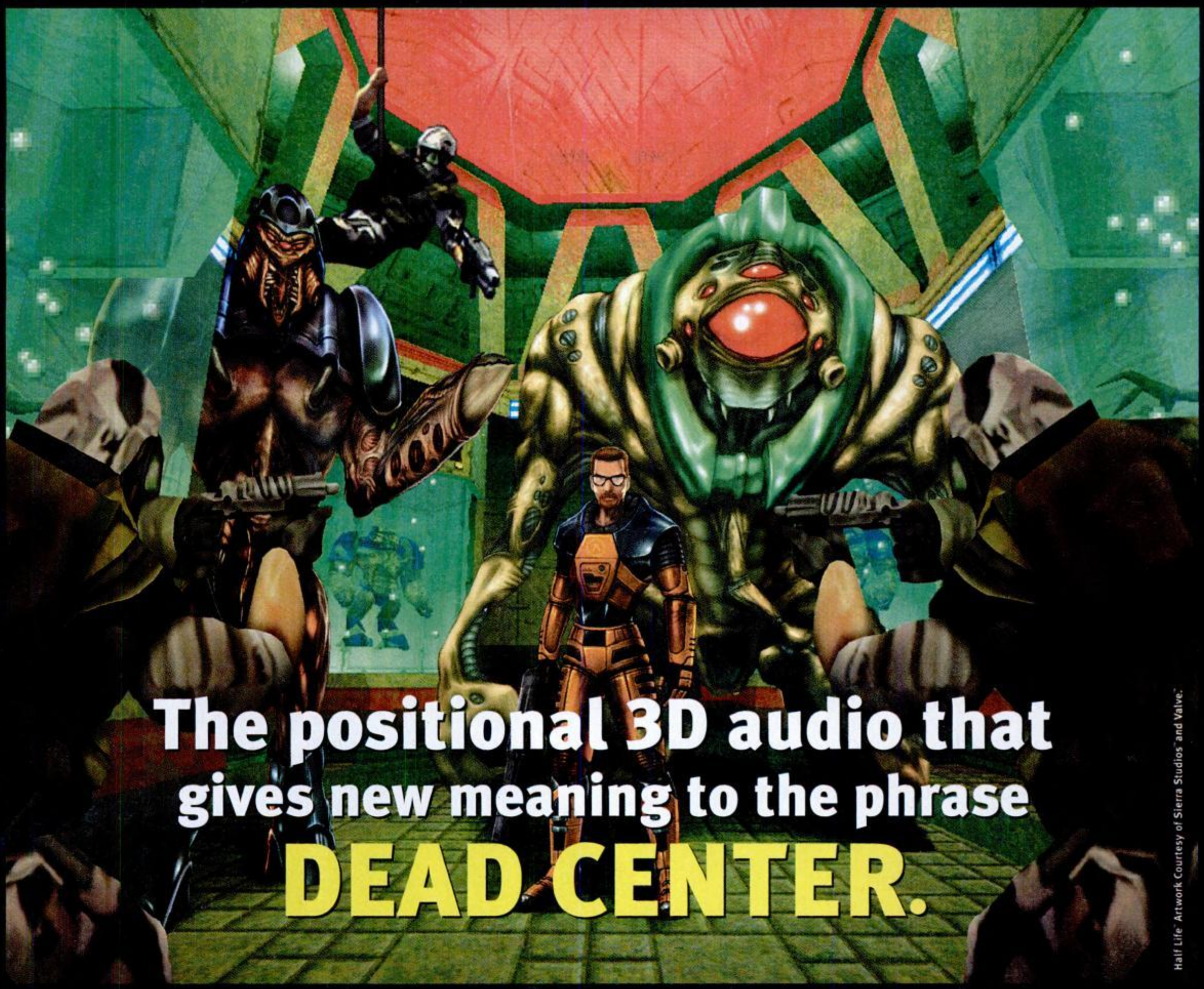

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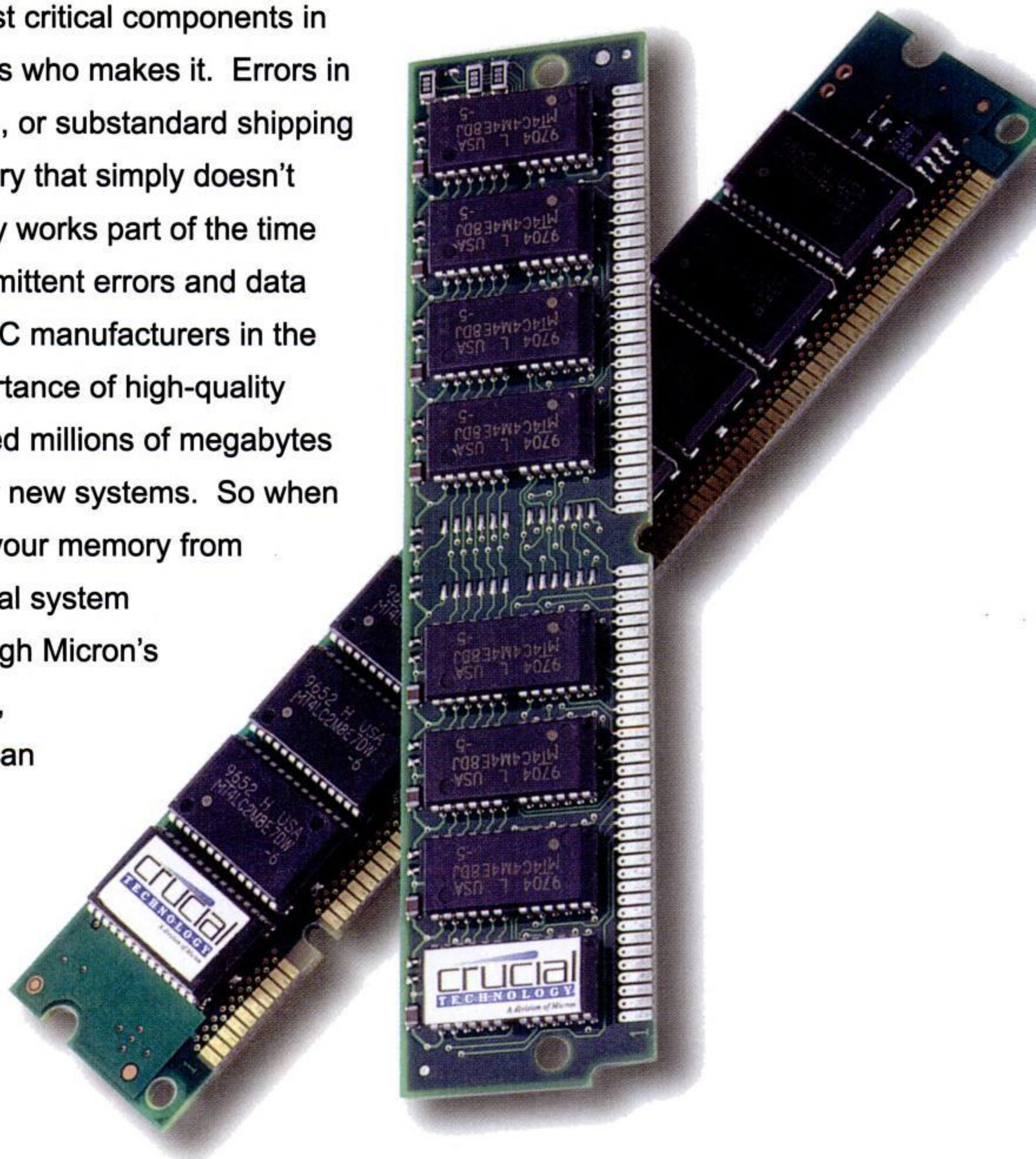

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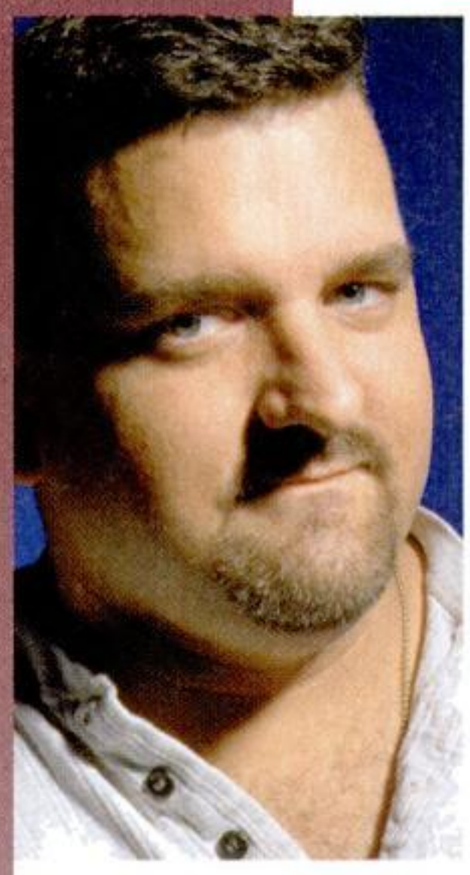
ED WORD

The Shape of Things to Come

As I write this, the last days of 1998 are winding to an end. Along with disappointments like Apple's iDiotic iMac and S3's ignoble Savage3D, we saw some absolutely killer tech in the last dozen: the realization of USB, AMD's resurgence, no-compromise notebooks. Rest assured—even more is headed our way in the next 12.



The even better news is that when a breakthrough product happens upon the scene, a new high-end is established and prices tend to plunge.

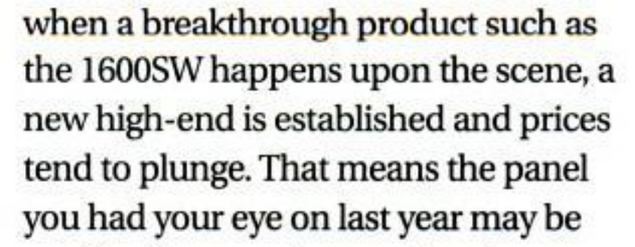
I want to take this opportunity to share with you some of the buzz we're tracking for '99 and solicit your input for hot topics that you have a burning interest in. Bomb your ideas to me at: **editor@maximumpc.com**. As always, you have my word that I personally read every letter and will use your feedback to tailor this book to your wants and needs.

One of the hottest technologies that looks to take off this year is **broadband Internet** access. Tapping the online world via cable and satellite dish came of age, but never made a major impact, with its limited roll-out. Fortunately, DSL shows genuine promise of shooting adrenaline straight into the heart of your browser. Serious players such as Compaq, Intel, Microsoft, MCI, Sprint, and a few Baby Bells are behind the latest standard, dubbed G.Lite. With this union of serious muscle and popular demand, we may see the end of long load times.

Another realm where we foresee big things is **home networking**. All the studies prove that more and more households shelter multiple PCs. As those with upgrade fever pass down their old rides to the kids (who will surely use them to overthrow the current status quo), more and more people are realizing the advantages of sharing resources such as printers and high-speed online connections. File sharing via sneakerNet is so 1998. And nothing compares 2 fragging U... in a multiplayer LAN fragfest. But who wants to strip out all the drywall and wire the house with 10BaseT? Smart companies such as Intelogis, ActionTec, and Tut may be small, but they have the right idea: Use your house's existing wiring (either phone or power lines, depending on the company). And perennial player Diamond has a wireless way to come together with its HomeFree cards, available in ISA, PCI, and PC card flavors.

After doing a roundup of reviews, we saw plenty of **flat-panel monitors** in 1998, and we liked what we saw... until we saw SGI's 1600SW. Then we hated ourselves for liking anything less. The good news is that with the emergence of this dominating display, flat panels need not eat sand ever again. In fact, traditional CRTs now have an uphill swim when it comes to getting on our desktops. The even better news is that when a breakthrough product such as the 1600SW happens upon the scene, a new high-end is established and prices tend to plunge. That means the panel you had your eye on last year may be coming down and competing to save you valuable desktop real estate. And, as K-Mart's tech maven says, that's a good thing.

There are plenty more twists and turns to come on the tech roller-coaster, starting with AMD, Intel, and Cyrix's plans to fuel-inject the core of the PC. And the third-generation of 3Dfx's Voodoo magic holds promise. PCI-based sound will also continue its unlikely journey into the third dimension. And who knows... Maybe someone will release a legitimate software title taking advantage of DVD.



Brad "Big Daddy" Dosland
Editor in Chief

MAXIMUM PC
feb99 vol4issue2

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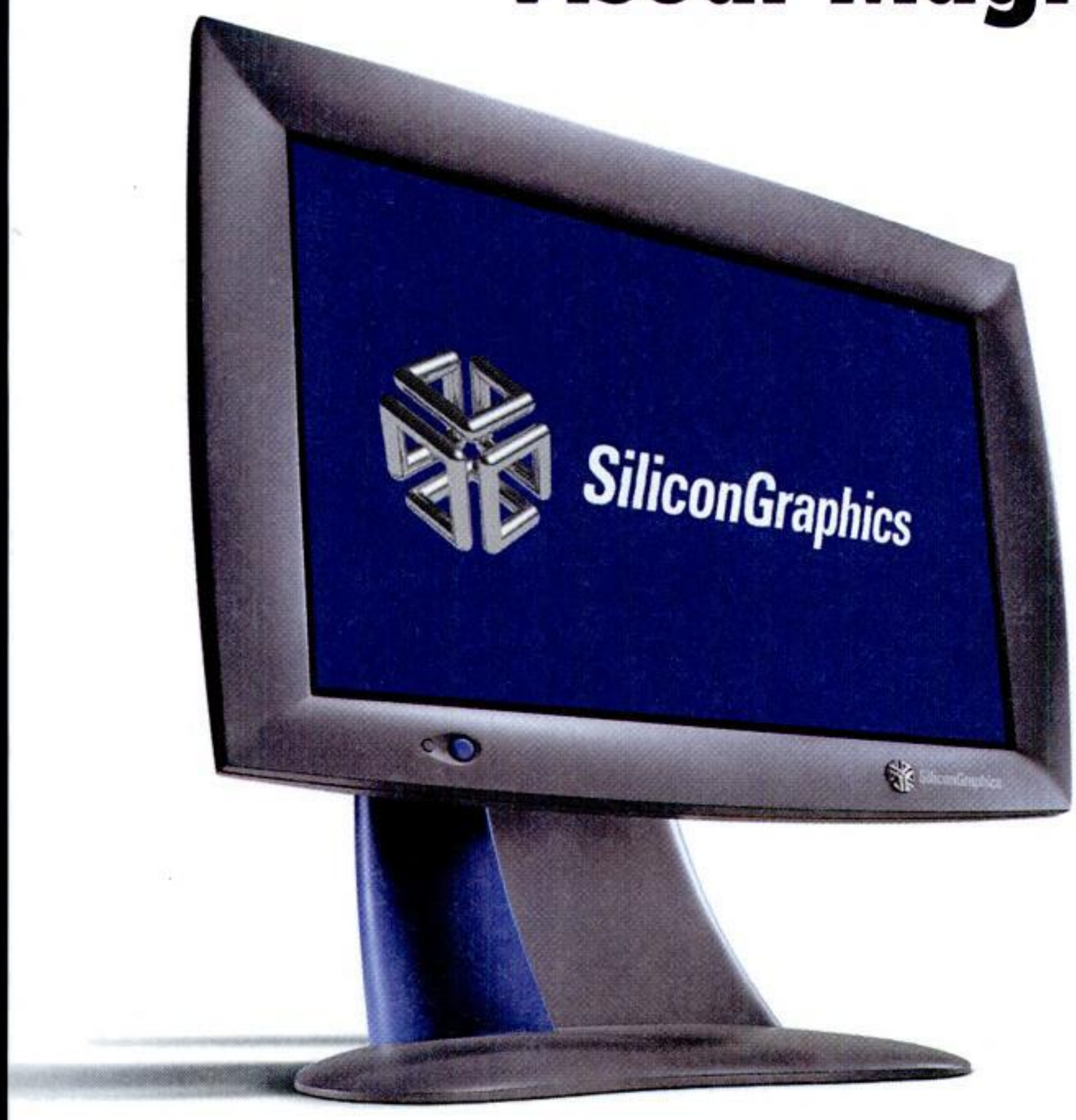

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"The first word that comes to my mind when describing NVIDIA's new TNT 3D graphic accelerator is WOW! The visual quality and frame rates...were astounding."

—Maximum PC, www.maximumpc.com

"...performance was better than any 2D/3D combo card I've seen. On top of that, games like Quake II and FLIGHT SIMULATOR 98 looked spectacular at 1024x768 and 1280x1024 (respectively)."

—Computer Gaming World, September 1998

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Letters from the Smartest Readers in the World

Here's the deal: You (being the smartest readers in the world) write letters about the magazine, the PC industry, the software you love or hate, and the hardware that runs it. We read it and share as much of it as space permits in the mag and online, and respond or comment when the letter calls for it. Get it? Now get busy and write us at **commport@maximumpc.com**

Meet Our New Columnist: Bill Gates

It seems that if you work for Microsoft and manage to get a nice glossy interview in *boot* magazine or *Maximum PC*, you get fired. Case in point: The Saint talks, gets booted. Now the unfortunate victim is the hip '70s dresser and Chromeffects chief, Eric Engstrom. Is it just my imagination? Next, Mr. Engstrom will probably be writing columns for *Maximum PC* too.

—Ashley Catron

News Editor Bryan Del Rizzo replies: Why do you think we're so hot to get Bill Gates to sit in the hotseat for us?

"It seems that if you work for Microsoft and manage to get a nice glossy interview in Maximum PC, you get fired. "

A Simple Request

What's the best motherboard, hard drive, CPU, and all the other stuff that's out there? I mostly play games, with a little *Photoshop* and *Illustrator* on the side. Could you please help me?

—keegang

Editor in Chief Brad Dosland replies: Sure kee, simply read every article in every issue of *Maximum PC* so far, and keep reading every month from now on. That's where we keep our specific recommendations.

Seriously, while we would love to provide pat answers for all the many readers who write in with this sort of question, we can't. And we wouldn't trust any magazine that did offer a simple list of what's best for you. "You" are just too diverse. Your individual needs span too broad a range. Some of you demand ultimate gaming of a video-card, some of you need digital-video-editing capabilities. Some soundcards are better for musicians, some are better for gamers. Some monitors make awesome graphics portals, some rage with DVD movies. And only you know how much you want to spend on any given part.

Ultimately, it would be an insult for us to assume your precise needs by providing simple short lists. While it requires more from you, reading the magazine regularly is really the best way to make smart decisions.

Katmai Fight

I read the Katmai article in the December issue of *Maximum PC*, and as an employee of AMD, I have to take objection to some of your comments.

According to a recent MicroDesign Report article, Katmai is not fully pipelined; it is a double-pumped pipeline, meaning each pipeline can only take a new issue on every other clock. So while Katmai has two pipelines just like the K6-2 (one for adds and one for multiplies), they can only execute at half the peak rate. Overall, since they have a wider SIMD word, they in fact have the exact same throughput as 3DNow!. Nothing is official, of course; however, what is telling is that Intel has confirmed a peak rate of 2.0 GFLOPS at 500MHz, which is exactly the same as 3DNow!'s peak rate.

Notably absent, so far, in all discussions of Katmai is latency. If the total latency of a KNI instruction exceeds 3 clocks, that could severely undermine KNI's real-world performance. Although Katmai instructions can run in parallel with the x87 FPU, it's hard to see how this will be useful. The x87 won't have anywhere near the performance of Katmai (or at least it shouldn't).

We do not believe Katmai is in any way more powerful than 3DNow!, and given that you start out the article basically admitting that you don't know the performance target, I don't see how you can come to the conclusion that it is. Katmai is targeted at the high end and costs a lot more to manufacture, and therefore costs a lot more on the street. This will serve to counteract the developers Intel has conned into supporting KNI, and probably cause a backlash (due to a lack of a real market) similar to what they experienced from developers that were burned with MMX.

—Bob Instigator

Executive Editor Jon Phillips replies: You're right about Katmai SIMD FP power vs. 3DNow! SIMD FP power: With respect to SIMD FP, the two technologies seem to be equal. We got conclusive verification of this when we met with Intel after the December article had gone to press. But in our defense, in the December issue we did report that it was unclear whether Katmai SIMD was more powerful. I wrote that if the Katmai CPUs launch

This month:

- **Has 3DNow! been slighted?**
- **Paying for Windows upgrades**
- **Readers debate 3Dfx**
- **The merits of Linux**

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with only one SIMD pipeline, they will essentially be equal in SIMD power to K6-2. Specifically, "Intel's intentions are vague; it's unclear whether the new processors themselves allow for two SIMD pipes." We think that language makes it clear that the KNI has the potential to outperform 3DNow!, but may not do so because of a specific implementation.

Also, the KNI article was marked "preview," which we think makes it very clear that benchmarks are not in yet, and that all reportage was preliminary and not conclusive.

In that same issue, we ran a gigantic three-page report on K7 and its awesome potential. Of course, that K7 story was also a preview, so it should be read as such. That is, without benchmarks, we can only report on a technology and make an educated guess re its ultimate worth.

As far as us reporting that KNI is more powerful than 3DNow!: Well... it is. It bears the same SIMD power, but adds memory streaming and some other things, as well. Benchmarks should bear out the benefits of the other additions.

Buying Windows in Installments

I was wondering if you know anything regarding Microsoft's latest stab at trying to charge Windows owners an annual fee to use its product. I heard it would not have the infrastructure to do so until 2001, and the idea was just being thrown around. I don't know if this is someone's idea of a joke, but if this comes to pass, there are going to be quite a few unhappy parishioners.

—Jason Hassler

Columnist Alex St. John replies: Actually Microsoft is very serious about making Windows upgrades a subscriber service. It has a large group of people devoted to making "Windows Update" happen. There are lots of advantages for the Empire in doing this.

1) It won't have to make monolithic product releases anymore. It can ship features incrementally, which means it can deliver new things in a more timely way.
2) Upgrades can be smaller, because they are more frequent.
3) You'll be bound to look at a Microsoft homepage with some frequency.
4) It can get a more regular stream of revenue from its customers.
5) It can figure out the "value" of individual components easily, and price accordingly.
6) It can reach a broader range of price tolerance for buying an OS, by effectively making it possible to buy software on a payment program.
7) It can reach its OEMs' customer base directly once the OEM has shipped a machine.
8) It'll have a really good excuse to get the contact information and credit-card numbers for every Windows customer in the world. Valuable info. You bet it wants to see this happen. This is much more than just a thought being tossed around.

Cola Wars

Is it just me, or is this whole Microsoft antitrust thing going way too far? Saying Microsoft must include Netscape's browser, if it wants to bundle *IE*, in Windows is stupid. That's like saying Nintendo has to include a Sega game with every N64.

And why did Sun sue Microsoft? So Microsoft altered Java a little so it would run more efficiently on Win98. So what? Does it affect sales of Sun workstations? Can you *really* own a programming language? Any judge that would rule in favor of Sun is too stupid to realize that Sun is just trying to get a check with Bill Gates' signature on it.

—Scott Paist

Online Editor Gordon Ung replies: Some believe asking Microsoft to include the Netscape browser is like asking Coke to sell Pepsi, while others think it's probably closer to, well, closer to asking Microsoft to stop breaking antitrust laws, bullying small companies and OEMs like some bad *Godfather* movie. And Sun would probably argue that Microsoft didn't "fix" Java to make it run better. It added Windows-only functionality to Java so as to wreck the whole idea of "write once, run anywhere." While WORA isn't a reality even without Microsoft's work, it's clear from depositions in the DOJ case that Microsoft viewed Java and the browser world as a serious danger to Windows.

"Contrary to popular belief, 3Dfx is not the god of 3D. In my opinion 3Dfx is overhyped, overmarketed, and overpriced."

Newbie Seeking Space

I am fairly new at the computer thing, and there's a lot I don't know. One thing I can't seem to find out about is compressing C: drives. My C: drive is almost full and there are a lot more things I want to put on it. On the properties, it says you can compress the C drive to free up 1183MB more space. Or it can use free space on C: to create a new compressed E: drive with 209MB. Is it good to do this? If so, which is better?

—Penny Steves

Department Editor Sean Downey replies: The Windows DriveSpace utility makes it all look enticing with pretty pie graphs displaying huge space savings, but hard drive compression is usually more trouble than it's worth. Compressing your hard drive makes file access noticeably slower, and turns scans and defrags into painfully sluggish hard drive thrashing sessions. I'd seriously look into upgrading to a bigger hard drive before dealing with the pain in the ass that is DriveSpace.

If you're stuck loving the drive you're with, give yourself some breathing room by flushing out your browser cache and temp files before doing some hefty spring cleaning. Hunt down all the unused software, WAV files, desktop themes, and tutorials on your hard drive, and blow them away. I also suggest converting your drive to FAT32 if you're running Win95 OSR2 or Win98, since you'll most likely gain some extra drive space through FAT32's smaller, more efficient cluster sizes. See the feature on page 54 for more ways to optimize your system.

3DAffected

3Dfx is going down. If 3Dfx does not support AGP DMA, large texture size, or 32-bit color, it will sink. I have purchased Voodoo and Voodoo^2 SLI in the past, but if 3Dfx refuses to add that functionality, I will not purchase Voodoo^3. I have a Riva TNT AGP board that has 32-bit color, and I can tell the visual difference. Also I've heard the current beta *Quake: Arena* runs faster on Intel's i740 graphics chip. This has to be due to AGP DMA or to limited texture sizes. That's the

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only speed-sensitive shortcoming of Voodoo² SLI. The high-res gaming of the TNT also kicks Voodoo² SLI's ass.

—Scott Ruggles

3Dfx obviously knows what it is doing, I mean, look at its competition. nVidia's TNT only matches the speed of the Voodoo². Yes, it has 32-bit color and yes, it has AGP 2x, and yes, it has blazing fast 2D. But who cares? Who *really* runs games in 32-bit color? 3Dfx has hit the nail on the head again with its upcoming V3. Based on the preliminary benchmarks, it blows away the TNT and even smokes 3Dfx's own Voodoo² SLI. Plus, it comes with sweet 2D and AGP! So, can you think of any competitors that can come close to that deal? I didn't think so.

—Tom Wieglenda

Contrary to popular belief, 3Dfx is not the god of 3D. Just take a look at ATI. They've been making 3D cards as long as S3, if not longer. They just re-released the Rage chipset with a few additions. (By the way my ATI Xpert '98 does 150fps running *Quake II* under OpenGL. I'd like to see a Voodoo card do that.) They added "Advanced 128-bit engine, SuperScalar Rendering technology (SSR), Twin-Cache Architecture (TCA) [that] incorporates texture and pixel cache to increase the effective memory bandwidth for extra performance, Single-pass Multi Texturing (SMT) capability, Concurrent Command Engine (CCE), which takes full advantage of AGP data flow techniques for unprecedented Pentium II performance". It also utilizes 32-Bit z-buffering and comes standard with 32MB of RAM.

In my opinion 3Dfx is overhyped, overmarketed, and overpriced.

—Travis Gish

I just got the new Banshee card from 3Dfx and it's a great card. I can run *Unreal* at 800x600 on my 166MHz Pentium. And it only cost $99! Why do people dislike this company? They just gave my computer a new lease on life.

—Mike McGinn

Linux Van Pelted

What's the big deal with Linux? All these people are saying how they want Linux really bad. But no one says why they *need* Linux! I mean, Linux is good for people into programming, even graphic design, but what is the average Joe going to do with Linux that they can't do with Win95! I'm not saying Win95 is better, I use Solaris (a version of Unix) every day writing Perl, but if I'm not doing that, I use Win95. Linux sucks for games. Not only is it hard to find games for it, it's hard to get everything working. Why waste four hours getting *Quake* to run on Linux when you could spend two minutes setting it up on Win95/98? And Linux is a pain to install. Unless you know what you're doing, you could end up deleting your whole hard drive, or burning out your video-card or monitor. Once it is finally installed, you think to yourself: "Now what?," and end up rebooting to Win95 to play some games or whatever you do.

—Yuri Bank

"All these people are saying how they want Linux really bad. But no one says why they need Linux!"

Former Webmaster Daevid Vincent replies: You have some very valid points and justified concerns. We believe the main reason people are clamoring for Linux is that they are sick of poor operating systems. How many times a day do you have to reboot a Windows machine? Or even a Macintosh for that matter? Unix and Linux are very stable. Linux has true multitasking and multithreading, as well as greater security and multiuser support. A family could have accounts for each member and not worry that little Johnny is going to delete Sally's homework or browse those "nasty" web sites.

Linux is much more efficient as well. The CPU runs cooler—extending battery life on notebooks—and equivalent programs run faster on Linux in a smaller hard-drive footprint. This brings up the point of equivalent programs. True, you can't run *Word* natively (there are Windows and Macintosh emulators that have varying degrees of success on various programs), but there are other options. Corel makes *WordPerfect* for example, and other suites such as *Applixware* and *StarOffice* have the same functionality for 90% of the users—complete with file compatibility

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for those still running legacy OSes. A majority of people these days use their computers for Internet-related tasks. There is no better OS for this than Unix. Period. Unix machines are the backbone of the Internet.

Agreed, Linux can be a bit tricky to install for a novice, but that's getting ever easier thanks to companies such as RedHat. Several vendors, such as VA Research, will sell it pre-installed on a custom-built machine, just like the big boys such as Dell, Gateway, and HP do—in fact, several of those OEMs are seriously considering offering Linux as an alternative OS to Windows.

Linux isn't a great gaming platform—yet. We know of a few companies and projects in the works that will change all that. Loki is one such company that is offering to port games over. Also for what it's worth, it might surprise you to know that several game developers use Linux to code core parts of their games, then port them to the legacy OS after a certain point.

It's ironic that the nay-sayers bag on Linux as a serious alternative operating system in favor of Windows, and yet the biggest gripe those folks seem to have is its lack of games. It begs the question, which OS is the gaming platform?

The Low-End Theory

I read your interview with Kevin McDonough from Cyrix (December 1998). This guy doesn't have a clue! Yes, his business is up because the sub-$1,000 market is beginning to blossom, but it certainly isn't the result of this guy's vision. He basically gives kudos to the iMac and it's "overall acceptance." Hello—McFly, anybody in there? He then goes on to talk about his vision of a server and a bunch of workstations in the home using an analogy about appliances in the 1900s? Hello again... Big difference. PCs are still primarily an entertainment item. He sounds like Trip Hawkins when Trip was trippin' on the 3DO console and edutainment. Game developers will always go to the extreme with technology... and they should. The thought of going back to nonscalable technology that's not based on distributed processing and has one single point of failure gives me the creeps. He mentions in his interview that they failed to see the impact of 3D and it hurt them. Hello again, 3D is gaming, and he's overlooking it once again.

—Brent L. McCleary

I read with interest and, I have to admit, sometimes laughed out loud at the interview of Kevin McDonough, senior vice president for Cyrix. I work part-time for a small computer store, and I see more and more people coming in to purchase high-end, 100MHz bus boards and PC100 DIMMs (usually 128MB to start), and round out the package with a 6GB+ HD and either a Matrox G-200 or an nVidia TNT. As more people realize that they want the power to play the top games, they'll demand top-of-the-line parts.

If Cyrix wants to market its chips to the low-end, it can sell all it wants to companies like Packard Bell.

And his claim of a chip with onboard video in the Voodoo^2 range is not just funny, it's hysterical. I bet the interviewer had to bite his tongue to keep from laughing in McDonough's face. I personally think McDonough's claims will prove nothing but vaporware.

—Fred Pate

"I bet the interviewer had to bite his tongue to keep from laughing in McDonough's face."

Philosophomoric

In the December 1998 Commport, Allen Murdock opines that "If thinking about having sex with someone other than one's spouse is adultery, then I suppose someone who fantasizes about murdering his or her boss is a murderer." Yes Allen, that's the way it is. Not that we need to re-write the laws and start the Thought Police, but the simple truth is that how we truly think in our heart is the way we truly are. If playing *Quake*, or any other game, is just one big murder fantasy-fest for you, then I suggest you think about what kind of person you really are, deep down, where the rubber meets the road. It is our first responsibility as human beings to do so.

—Whit McClendon

In the December issue, Allen Murdock replies to a previous letter that commented on how "fantasizing about murder is murder" and how a deeply religious person must be committing sin by playing *Quake*, I would object. The scenarios of such games are that the player must fight back the legions of evil creatures. In these games, the player is in essence, "walking through the shadow of the valley of death, and fearing no evil". In the strictest of Biblical passages, it is not a sin to destroy evil.

—Damon Appel

If, in your heart, you want to kill someone or have sex outside of marriage, but don't actually commit the act, you are still guilty in the eyes of God. If you want to kill people, have adulterous relationships, etc., that is considered evil and is the same to God as if you actually did the act. Does Mr. Murdock actually believe that harboring thoughts of killing someone is *good*? Don't you think people who kill actually want in their heart to kill? As far as games that involve killing, if in your heart you wish it were real, consider yourself a potential killer.

Jesus said in Matthew 5:27,28; "You have heard it said, 'Do not commit adultery.' But I tell you that anyone who looks at a woman lustfully has already committed adultery in his heart." Where do you think the term "if looks could kill" came from?

—Scott Brennan

No-Frills Hardware

I'm shopping around for a TNT-based card and have found an excellent price for the OEM Viper 550. The ad says the only difference is "no TV-out." Is that really all I give up, or is there more to the story? What about with other OEM parts versus retail parts, such as CPUs?

—C. S. Cannella

News Editor Bryan Del Rizzo replies: You can also kiss goodbye such things as dedicated technical support, driver stability, multiple memory configurations, and a software bundle. Although the hardware itself is probably fine, there's a possibility that it may not include all the bells and whistles that its retail counterpart has. OEM parts are sometimes custom created for a particular vendor, as is the case with nVidia making special boards for Gateway and Compaq that include TV-out and digital flat-panel interfaces, and it's possible those boards have found themselves being sold on the open market. Check the specs and find out who actually made the board. If nVidia or one of its vendors (such as Diamond or STB) makes the part, great. If not, it's probably designed by a second- or third-party manufacturer. Many OEM cards will just include the card and software drivers. But you won't get a box, manual, or software bundle.

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HAIL CAESAR, YOUR

ACTOR

Can't flub my lines again or the director said he'd turn me over to the lion tamers! Okay... "Et tu Bruno? No, that's not right. "Et tu Brunhilda?" Arghh!!

VINTNOR

Look at this! I've got grapes rotting on the vine! With the shipbuilders on strike, I can't ship my wine to the rest of the Empire. My warehouse is full, and boy do I have a hangover...

GLADIATOR

I've got to get to the Temple of Mars to make a sacrifice before tonight's contest in the Coliseum. I think I'm losing my touch. Last night the lions nearly took my head off! If only I hadn't missed that last lesson at the Gladiator School...

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"I find myself continually drawn back to the game to try just one more tactic... To paraphrase Shakespeare's Antony, 'I come to praise Caesar III'."

– JOHNNY WILSON
EDITOR-IN-CHIEF, COMPUTER GAMING WORLD

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– ONLINE GAMING REVIEW

"...the Caesar series is a classic that's only getting better with age."
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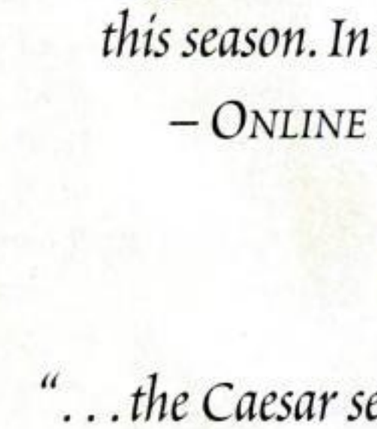

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SIERRA STUDIOS
Impressions

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CENTURION

March, march, march...Got to keep on the lookout for the Barbarians. Oh yeah, and rumor has it the Carthaginians may be on the move again. Wait! Is that a camel over there?

PRIEST

I don't know what the world's coming to these days. Young people run wild in the streets, forgetting all about the gods. I don't know where I'm going to find enough Vestal Virgins this year...

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BUILD A BETTER ROME

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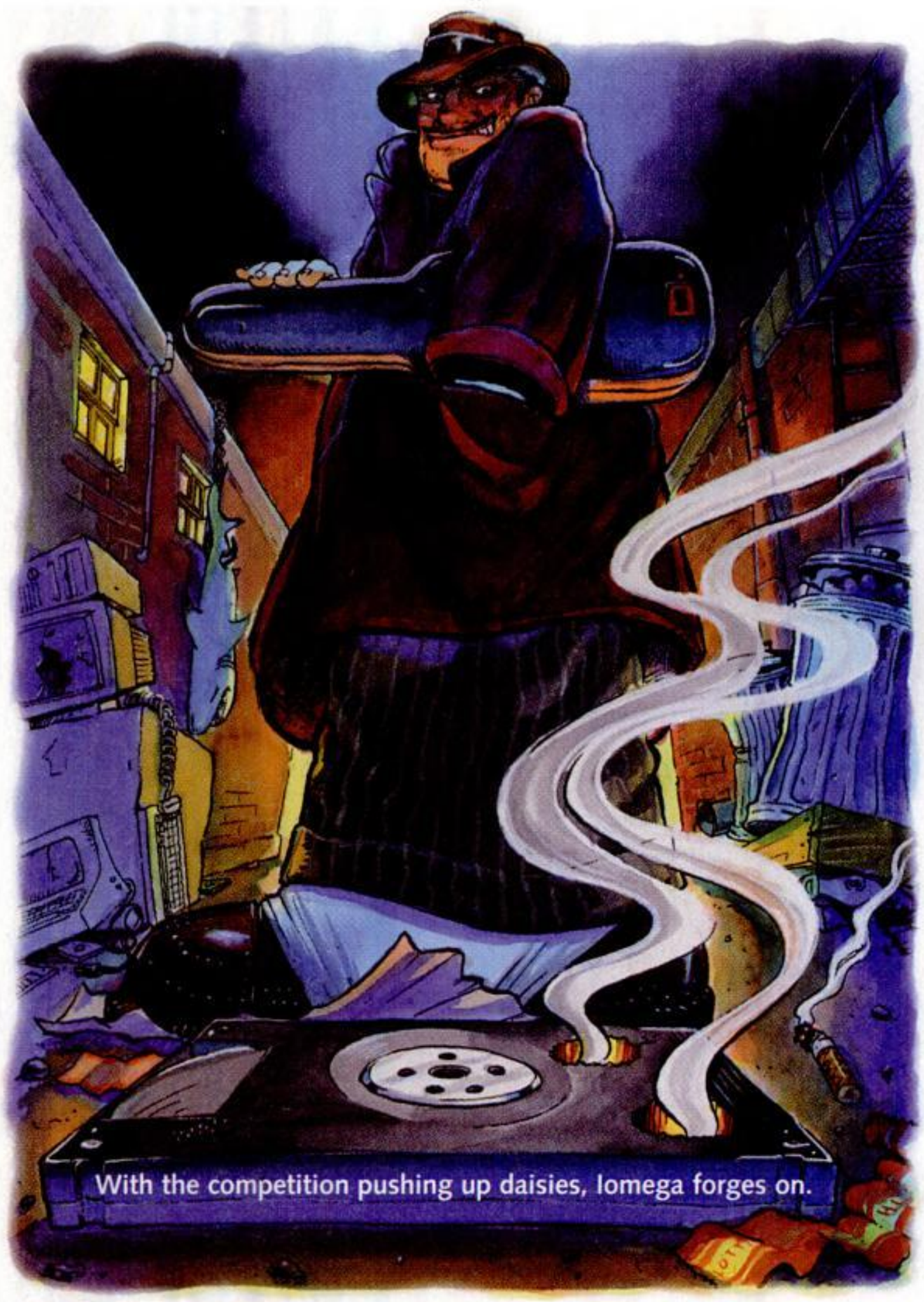
Storage Companies Found Dead



With the competition pushing up daisies, Iomega forges on.

ILLUSTRATION BY SCOTT PECK

Iomega not a suspect

If you think of the storage market as a mob movie, the last few months would be just like the end of the *Godfather*.

Avatar Peripherals and its rugged Shark drive? Whacked and spending time with Jimmy "My body will never be found" Hoffa.

Nomai—which never really carved out turf in America? Found in a car trunk in Jersey.

And then there was SyQuest, an old timer and former industry leader on the road to recovery. Just when you thought SyQuest would become a player again: Bang. Two in the head while leaving a social club on the South Side.

So what's causing this consolidation among the storage families? While it's easy to attribute the chalk outlines on the sidewalk to stiff competition and a weakened Asian economy, industry analysts say each company had a play in its own demise.

Case in point: Avatar Peripherals' Shark. Respected as a durable and reliable performer, the 250MB drive simply never caught on. Part of the fumbling was marketing it to a questionable niche category. The diminutive drive was designed and sold solely as a mobile product. When the numbers didn't nail it, Avatar nailed itself and filed for Chapter 7 liquidation late last year.

SyQuest's fall from grace was much more meteoric, throwing sparks still seen today. Old timers will remember the days when SyQuest's 44MB and 88MB removable drives ruled the prepress planet. Then a familiar technology story occurred: The company squandered its lead , despite a comeback rally with such viable products as SparQ and SyJet.

"SyQuest overspent drastically on promotion," said Jim Porter of industry newsletter Disk Trend, citing cash splurges on things such as full-page ads in the *New York Times* and *Wall Street Journal*. And anyone who attended Comdex can attest to SyQuest's ads on the back of nearly every taxi in town. The company also spent massive amounts of capital on its factories anticipating huge sales. "It turned out the market wasn't as big as they thought it was," Porter says.

Still, SyQuest achieved sizable penetration in its last few months. Market share figures from Dataquest show SyQuest had 25% of hard-disk-based removable drives for

SPIN CYCLE

This month's top stories broken down ►

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Palm VII Closes the Gap on Star Trek's Communicator	Skipping right past the Palm IV, V, and VI, 3Com announced its Palm VII organizer. The latest version of the popular PDA focuses on wireless communication.	Palm VII will begin field testing in early 1999 and should hit store shelves shortly after at $800. Palm.Net Internet service for the device will start at $10 a month.	"The Palm VII is our first step in enabling a new class of information access and e-commerce for the handheld computing industry," said 3Com's Janice Roberts.	Vertical marketing leaves consumers—the people who made the PDA's popularity soar—behind.
Windows 98 Primed for Year 2000	Microsoft has released an update to Windows 98 that fixes problems that would have arisen when 1999 rolls into the year 2000.	The identified issues posed no risk of data loss or PC damage. Microsoft released the free fix to alleviate consumer fears of catastrophic events on the dreaded date.	"In the course of Microsoft's ongoing testing efforts with Windows 98, we have identified and fixed minor year 2000 issues," said Microsoft's Rich Kaplan.	The issues included date rollovers, WordPad irregularities, and LAN log-ins, but nothing serious. Get the free update at http://windowsupdate.microsoft.com or 800.363.2896.

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1997. Bob Amatruda, a senior analyst with International Data Corp., estimates SyQuest's 25% jumped up to 37% in 1998.

"SyQuest hit that emotional price and capacity point, there's no question about it," Amatruda says. But because its products were priced so low—under $200 on average—SyQuest found itself competing with Iomega's lower cost (and cheaper to manufacture) Zip drive. Making matters worse, SyQuest didn't generate as strong revenue streams from sales of its media, which are now ubiquitous in the pre-press market. The typical Jaz owners in vertical markets stocked up on the expensive 1GB and 2GB media cartridges; buyers of SparQ and SyJet tended to buy just one or two cartridges.

The show finally ended for SyQuest in November when it filed for bankruptcy just as Fall Comdex was underway. News of SyQuest's end was the talk on shuttle buses, and rumors circulated that SyQuest officials were walked off the convention floor by police for passing bum checks. Consumers who bet on its drives also took a bite: thousands are without support and dozens of others have reported losing their drives in for repair when SyQuest shut its doors. (For consumer action news on SyQuest, see the Watchdog section on page 31.)

Nomai's problems began when it became ensnarled in worldwide litigation with Iomega over the right to produce Zip diskettes. Nomai also produced its own hard-drive-based 750C and 540 drives, but they never became popular in the United States. According to DataQuest, Nomai's sales of removable drives amounted to a piddling 30,000 units shipped, or 2.2% of the world market in 1997, fewer even than Avatar.

Iomega and Nomai finally settled litigation in June 1998 after it appeared the courts would rule in favor of Iomega. The prize? Iomega was to take a majority stake and control of the French company. Nomai has already agreed to stop producing Zip disks, and analysts expect Iomega to throttle back Nomai to producing optical rewritable technology.

"SyQuest overspent disastrously on promotion. It turned out the market wasn't as big as they thought it was."
—Jim Porter, Disk Trend

In the end, Iomega stands much like Michael Corleone, but not without damage or competition. Although it has beat earnings estimates, Iomega stock has taken hits, with the company reporting a $7.6 million net loss in its third quarter. The year before, Iomega posted net profits of $30 million.

Although Iomega has seen SyQuest, Avatar, and Nomai fall within months of each other, giant Sony is prepared to release its 200MB floppy replacement, SuperDisk is gaining more OEM wins every day, and new competitor Castlewood Systems plans to sell its 2GB removable drive on the retail market.

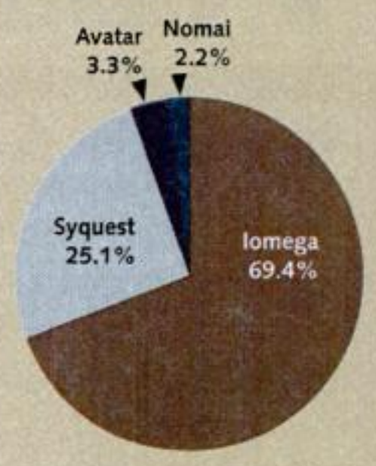
The future for mass removable storage appears fuzzy for manufacturers and consumers. Although prices of optical drives such as CD-RW and DVD-RAM have come down, performance issues will keep them out of the market for anything but archival use.

Today, Iomega is the king of the hill, with more than 18 million Zip and Jaz drives sold. For now and the foreseeable future, you should kiss the ring of Don Iomega. ✹

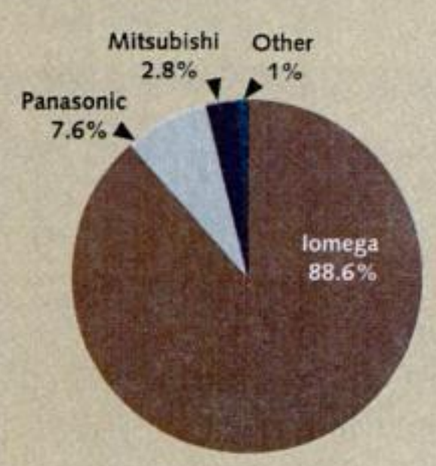
Who's On Top?

Now that most of the competition has been off'd, is it any wonder Iomega accounted for the majority of the removable storage market? We offer this proof:

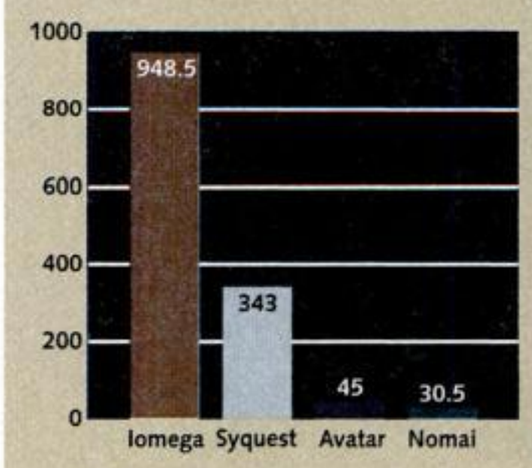
IOMEGA JAZ'S PERCENTAGE OF REMOVABLE RIGID DISK DRIVE SALES IN 1997



IOMEGA ZIP'S PERCENTAGE OF HIGH CAPACITY FLEXIBLE DISK DRIVE SALES IN 1997



UNIT SALES (in thousands)



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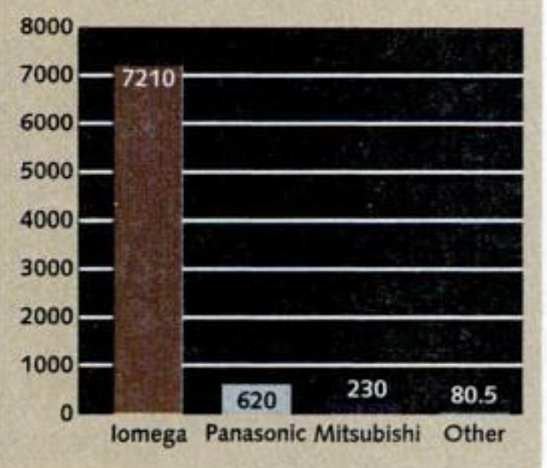

SOURCE: DataQuest

to the pertinent details.

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HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Intel Scores Victory in E-Mail Spamming Case	A preliminary injunction that forbids a former Intel engineer from "spamming" his former co-workers may affect unwanted e-mail communications with corporations.	Ken Hamidi, a former Intel engineer, was ordered to stop sending e-mail to current Intel employees. He was accused of sending a warning about Intel's HR department.	Intel argued that "Hamidi is trespassing on Intel property, his e-mails waste company resources, and that e-mail addresses are confidential and proprietary property."	Should Intel prevail at trial, the ramifications could be enormous, especially regarding First Amendment rights. Still, spam is spam, and should be stopped at all costs.
PowerVR Starts Sampling New Chip	The PowerVR 250 will integrate a 2D/3D core, accommodate up to 32MB of SD/SGRAM, and offer optimized support for Pentium II and 3DNow!.	Specs include a tile-based, reduced-bandwidth rendering engine, 32-bit floating-point z-buffer, D3D and OGL blend modes, environment mapping, and TV-video interfaces.	"The launch of PowerVR 250 completes the first phase of our cross-platform strategy for the second-gen technology," said VideoLogic's Trevor Wing.	NEC claims multitexturing will be performed at the back end of the 3D processing pipeline. Whether this will be more advantageous than other designs remains to be seen.

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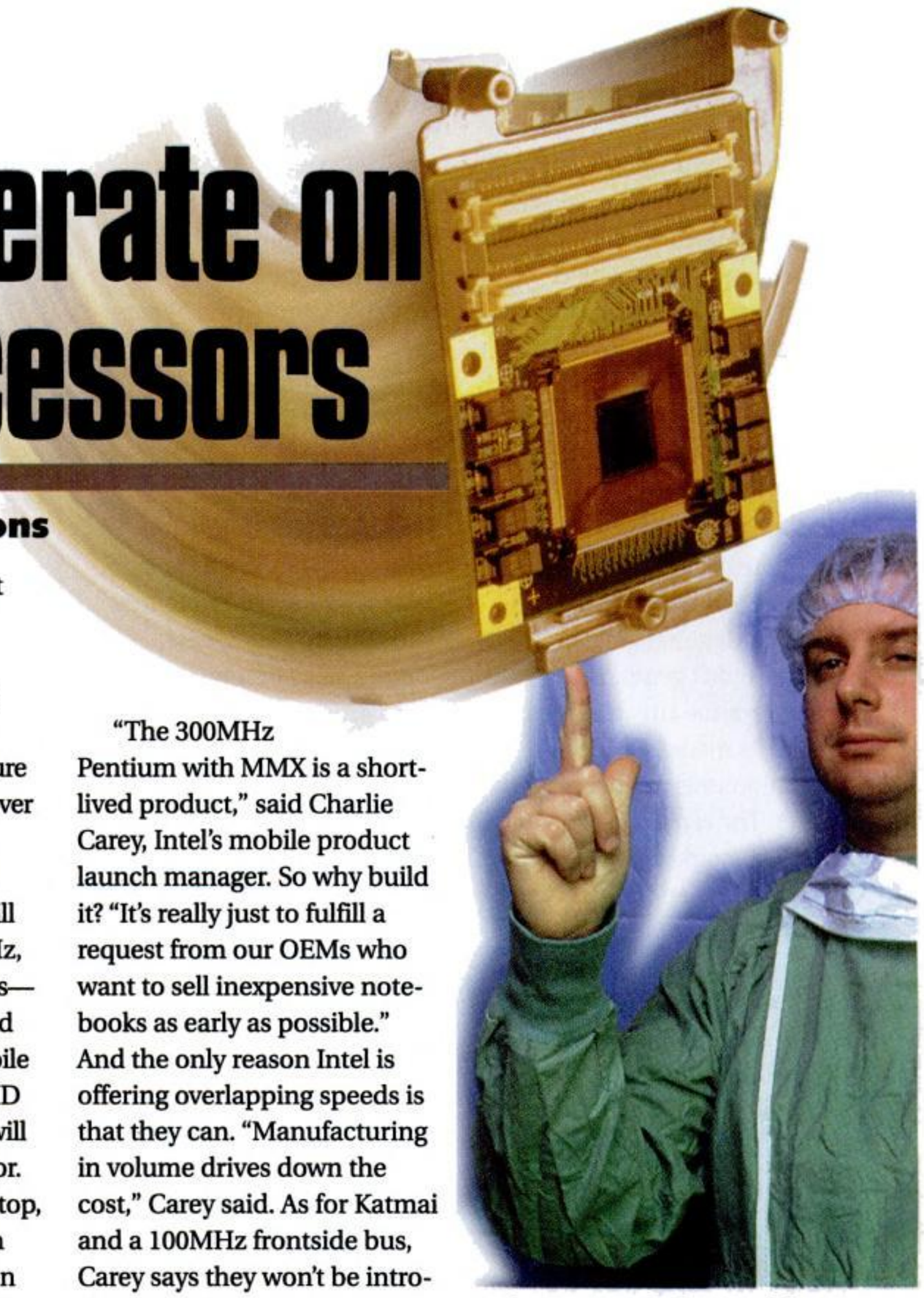
Intel, AMD Operate on Portable Processors



New chips, new speeds, new instructions

Until recently, PC power users felt notebook computers were about as useful as a leaky colostomy bag. But in 1998—with the introduction of AGP graphics, DVD-ROM, and 15-inch screens—the mobile condition was finally upgraded from critical to stable; for 1999, the processor prognosis looks even more promising.

AMD started shipping its regular K6 mobile processors in early 1998, and by year's end had experienced moderate success. In 1999, AMD will introduce its 3DNow!-enhanced mobile K6-2, and the even more buffed K6-3—code-named Sharptooth. The mobile K6-2 is positioned against Intel's mobile Pentium II and Celeron processors; the K6-3 against Intel's yet-to-be-seen Coppermine and Dixon parts.

"When we first got started in the mobile market, we were basically just plugging into existing sockets that had been designed around the Intel chipset," said Martin Booth, AMD's mobile products marketing manager. "But we're starting to roll out our Super 7 infrastructure and have started a massive development effort with our OEMs and partners."

AMD's Super 7 infrastructure boasts an important feature over Intel's mobile platforms—a 100MHz frontside bus. And although the mobile K6-2 will initially be offered in 266MHz, 300MHz, and 333MHz flavors—one bin below Intel's expected top-of-the-line 366MHz mobile Pentium II—AMD hopes 3DNow! will be a differentiator.

"MHz speeds just aren't relevant anymore,"
—Intel's Charlie Carey

"On the desktop, the emphasis on 3DNow! has been in the gaming area. But 3DNow! can also boost the performance of soft modems, 3D web browsing, and presentation software," Booth said.

So will Intel's market share go into remission? Unlikely. However, with no less than six mobile processors and two core-logic chipsets planned for release throughout the year, Intel will have its hands full keeping potential consumers out of the psych ward.

"The 300MHz Pentium with MMX is a short-lived product," said Charlie Carey, Intel's mobile product launch manager. So why build it? "It's really just to fulfill a request from our OEMs who want to sell inexpensive notebooks as early as possible." And the only reason Intel is offering overlapping speeds is that they can. "Manufacturing in volume drives down the cost," Carey said. As for Katmai and a 100MHz frontside bus, Carey says they won't be introduced until Coppermine is born, sometime in the second half of 1999.

Intel is also nurturing two core-logic chipsets: 440BX and 440DX. "BX and DX work with both the Celeron and Pentium II lines, but DX is a lower-cost version that doesn't support AGP." As a result, expect to see a lot of Celeron-based notebooks using the DX chipset.

So how do you know which mobile chip will be right for you?

The prognosis is good for mobile power users.

"The biggest differentiator is MHz speeds—but they're just not relevant anymore," said Intel's Carey, who cited the performance of Intel's 300MHz Pentium with MMX vs. the 266MHz Celeron as justification. "Looking at only the raw MHz can be a big disservice."

In other words, always ask for a second opinion. ✹

SPIN CYCLE

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HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Intel, VIA Technologies Sign Patent Agreement	Under the terms of the agreement, Intel has granted VIA a patent license to manufacture and sell certain Apollo Pro chipsets for Intel's P6 bus microarchitecture.	VIA will have to pay Intel royalties on the products licensed and has even granted Intel a cross-license under some of VIA's patents.	"Our agreement with Intel further demonstrates VIA's commitment to expand the market for cost-effective, feature-rich PCs," said a company press release.	When VIA introduced its Apollo Pro—the first non-Intel Slot 1 core-logic chipset—we thought Intel would protect its intellectual property through legal enforcement.
Consumers $1M; Iomega $0.	Iomega agreed to pay the largest civil penalty ever for failing to ship product rebates—from sales of its popular line of Zip drives—to retail customers.	Iomega will pay $900,000 to the Federal Trade Commission for allegedly failing to provide rebates and refunds. The allegations stem from 1996.	The company was tight-lipped at press time.	Burned consumers can take solace in the fact that the settlement is the largest penalty paid for a noncriminal violation of the Mail Order Rule. It pays to complain.

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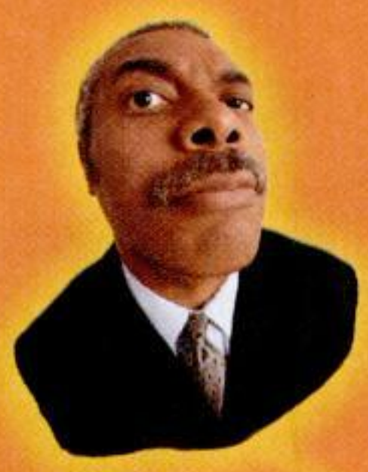
Forgot his number?
Just say his name
and let Voice
Command do
the dialing.



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Using Caller ID*, it can
identify her and deliver
a personalized promise
to call more often.

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And he has seats for
the game. Set Caller
ID Announce to say
his name out loud.

It's crazy.
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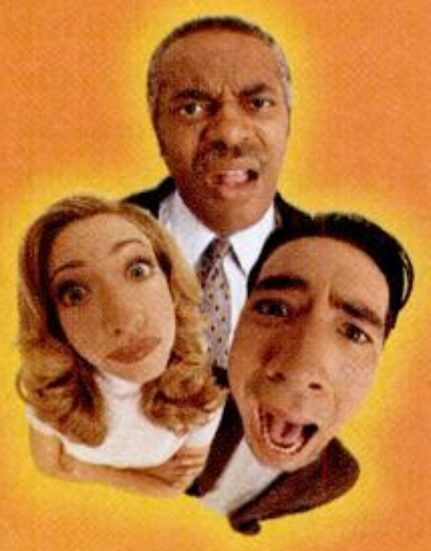

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trend ► internet business

You've Got... Netscape?

Netscape's Marc Andreessen and AOL's Steve Case are the internets' latest gruesome twosome.

AOL blows $4 billion to buy Netscape

Bill Clinton's impeachment proceedings aside, AOL's purchase of Netscape Communications for a staggering $4.2 billion may turn out to be the story of the year. So, should you give a darn?

From a consumer perspective, the deal doesn't—at least in the foreseeable future—mean much will change in the way you use the Internet.

"AOL is a big competitor to many ISPs, and the fallout may be that some will decide not to distribute Netscape's browser products," said Jeff Narucki, senior analyst for Progressive Strategies. "After all, why should they provide an advertising vehicle for their competition?"

The core deal, essentially a stock swap between AOL and Netscape, is expected to be ratified sometime this spring. AOL also announced a major alliance with Sun Microsystems, which will pay Case and Co. $350 million in marketing and licensing fees to gain access to Netscape's enterprise applications and server software. In return, AOL will invest half a billion dollars in Sun hardware and services over the next three years.

"AOL gains three things from the acquisition," said GIGA's Andrew Bartels, research analyst for electronic commerce. "It strategically ensures that AOL does not have to be dependent on Microsoft for browsers; it diversifies and strengthens AOL's customer offerings to experienced Internet users who have traditionally shunned the service; and it cements AOL firmly into the growing space of electronic commerce." The day the deal was brokered, AOL renewed a deal for Microsoft's *Internet Explorer*, to avoid losing prominence on the Windows desktop.

"The deal cements AOL firmly into the growing space of electronic commerce."
—Andrew Bartels, GIGA

Sun and Netscape stand to benefit from the deal too. In addition to the half billion dollar sale of hardware and software to AOL, Sun will have access to browser and server products competitive to Microsoft, and potentially attract AOL's 14 million users to its Java language. And Netscape? The brand—and the company—get to stay alive.

Netscape's Netcenter portal has proven popular. But Bartels cautions portals aren't necessarily a financial nexus.

"In many ways portals just imitate AOL," Bartels said. "If you can cluster enough goods and services around the site, you may be able to hold customers in that location. But sometimes they'll jump and bypass the portal." AOL will continue to make money from service access fees, but there's sure to be some fallout in the portal partners moving forward.

Although AOL is rumored to be moving away from its proprietary interface (the company did not respond to our repeated requests for an interview for this story), AOL clearly has its sights on Microsoft in more than one way. Recently, a report surfaced that AOL is looking to build set-top boxes that would compete against Microsoft's WebTV product. The kicker? AOL's hardware would utilize Netscape's browser technology instead of Microsoft's Windows CE.

SPIN CYCLE

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Computer.Com Can Be Yours for Only $500,000	For sale: the computer.com web domain name. The price? A paltry $500,000. In cash.	Owner Kevin Sinclair wants even more—the half million-dollar figure represents the minimum cash bid. If you're a start-up or public company, a stock swap might suffice.	"Branding is critical," said Sinclair, "and computer.com is the first web page displayed in browsers when end-users type in the word 'Computer' for a location."	This is absolute insanity. But if you think this is bad, there's more—the owners of beef.com are asking at least double.
Linux Garners Game Support	A newly formed software company has announced it will begin commercially porting top-selling games to the Linux platform. Games will appear early this year.	Loki Entertainment Software said it is negotiating with publishers to migrate existing games to Linux. The pricing will be similar to that of other platforms.	"Linux is supported by a rapidly growing community of sophisticated users who gravitate toward computer games for entertainment," said Loki's Scott Draeker.	Linux is definitely on the upswing, and games as we know sell hardware. More software support = more users.

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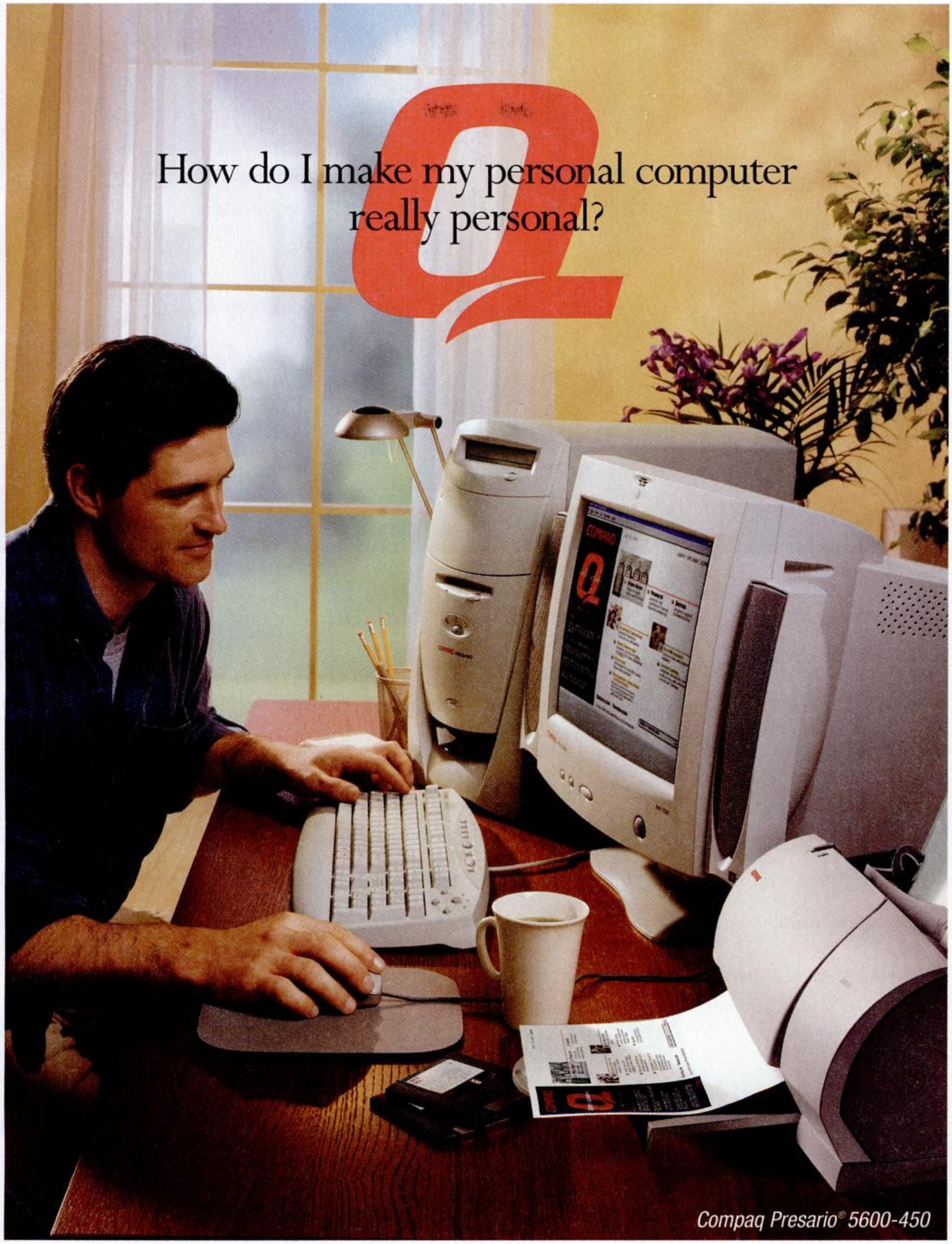

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- Aureal 8820 PCI Audio Card
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- 2X AGP Graphics w/8 MB SGRAM
- Aureal 8820 PCI Audio Card
- 10 Mbps Ethernet Port, Cable Modem Ready
- JBL Pro Speakers
- Digital Creativity Imaging Center
- Microsoft Featured Home Collection
- Microsoft Windows98
- Compaq V720 17" Monitor (15.9" VIA)

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Base price includes:

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- 128 MB SyncDRAM expandable to 384 MB
- 56K ITU V.90 Modem[2]
- 2X AGP Graphics w/8 MB SGRAM
- Aureal 8820 PCI Audio Card
- 10 Mbps Ethernet Port, Cable Modem Ready
- JBL Pro Speakers
- Microsoft Office 97 Small Business Edition
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- 16 GB UltraDMA Hard Drive:[1] Add $89
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- 56K ITU V.90 Modem[2]
- 2X AGP Graphics w/8 MB SGRAM
- Diamond Monster Sound MX300 PCI Audio Card
- 10 Mbps Ethernet Port, Cable Modem Ready
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- 64 MB SyncDRAM expandable to 160 MB
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- 2nd-Generation DVD-ROM Drive[6]
- 56K ITU V.90 Modem[2]
- Smart Lilon Battery
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[5]The 6X DVD-ROM Drive transfer rate is up to 8,115 KB/s compared to 1,352 KB/s for 1X DVD-ROM Drives. [6]2nd-Generation DVD-ROM Drives run at a higher maximum transfer rate of up to 2.76 MB/s compared to 1st-Generation DVD-ROM Drives which run at a maximum transfer rate of up to 1.348 MB/s. [7]One year parts and labor. [8]G.Lite/56K V.90 updates may be downloaded from the Compaq Web site when available. The G.Lite/56K protocol is designed to allow faster downloads from G.Lite/56K V.90 compliant digital sources. Availability of G.Lite/56K V.90 services will vary by region and Internet Service Provider (ISP), and may differ from V.90 ISP services. Maximum achievable download transmission rates with G.Lite/56K V.90 are currently unknown and may not reach 1.5Mb, and will vary with line conditions and distance. Labor for desktop systems is carry-in service with on-site service during the first 90 days of ownership. Labor for notebook systems is pick-up service. Compaq is not liable for pictorial or typographical errors in this advertisement. Compaq, the Compaq Logo, and Presario registered in U.S. Patent and Trademark Office. Microsoft, MS, and Windows are registered trademarks of Microsoft Corporation. Intel, the Intel Inside Logo, and Pentium are registered trademarks of Intel Corporation. Product and company names mentioned herein may be trademarks and/or registered trademarks of other companies. **Call Compaq Monday-Friday 7:00am-11:00pm (CST), Saturday and Sunday 7:00am-7:00pm (CST).** ©1999 Compaq Computer Corporation. All rights reserved.

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WATCHDOG

▶ Maximum PC takes a bite out of bad service and gear.

INFO PERIPHERALS TORPEDOED?

DEAR DOG Since sending my scanner to Info Peripherals on October 9 for repair, I've called nine times, e-mailed twice, and faxed letters to the president and vice president of the company without ever getting a response. My scanner is under warranty and I have an RMA number. This is unreal.

—Stanley Young

No one bothered to answer the phone at Info Peripherals' office in Campbell, CA. After realizing Info Peripherals' toll-free number had been disconnected, THE DOG tracked down the original owner of Info Peripherals, Harry Brix. Brix said he sold the company off for a loss to a consortium of Taiwanese firms in early 1998 and believed it was still solvent. THE DOG hoped so too because a search of the bankruptcy filings didn't turn up a clue on the status.

THE DOG did finally track down a former associate who said Info Peripherals had just gone through a restructuring and was in the process of moving its operation overseas. The associate did provide a super hush-hush number to directly contact Paul Lee, president of the company. When THE DOG finally reached Lee, he wasn't too helpful, however. Here's the quick take:

DOG "Can you tell me if Info Peripherals or Info Connections is still in business?"
LEE "I have nothing to tell you right now."
DOG "Will the reader be able to get his scanner back?"
LEE "I'm sorry, I can't tell you anything. Thank you."
DOG "Is there anyone else I can talk to?"
LEE "Thank you. I'm sorry."

With this kind of response, we can guess that Info Peripherals is headed one way. THE DOG will keep an ear on this company, but until you hear more, consider Info Peripherals in the DOG HOUSE. Woof.

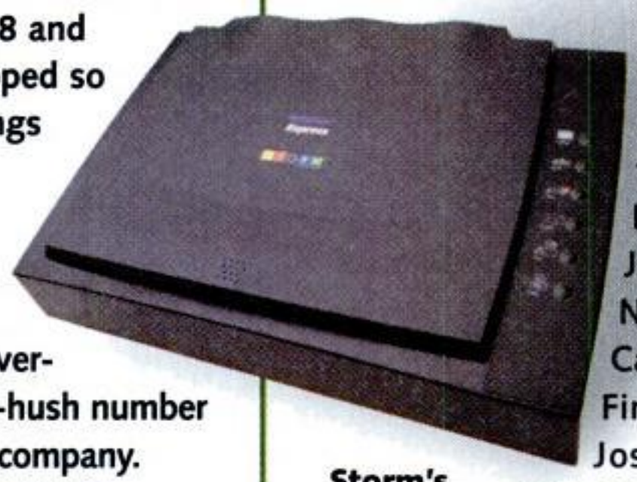
STORM TECHNOLOGY RAINED OUT

The same month Info Peripherals stopped answering its phones, STORM TECHNOLOGIES filed for bankruptcy and began liquidating its assets.

Storm's nifty PageScan USB scanner was the device Bill Gates used to demonstrate to the world how well USB worked with Windows 98. Gates ended up with egg on his face when Windows 98 gave him the big blue screen of death. It was no fault of the PageScan, Storm officials told The Dog months before the company died.

THE DOG has heard complaints from several Storm users. Most report their main gripe to be a lack of promised $30 and $50 rebates, which Storm pimped on its web site until it filed for bankruptcy. Others wanted to know if they could get service and drivers. Fortunately, few users lost equipment when Storm flopped over.

Tenacious consumers may want to get in line as creditors of Storm Technology to claim their rebates. The case, No. 98-58595, is filed in the U.S. Bankruptcy Court, San Jose Division of the Northern District of California. 280 South First St., Room 3035, San Jose, CA 95113. It may take months and not result in much, but it can't hurt to spend the minutes to file the claim form and the 32 cents to mail it. Claim forms are available from your closest bankruptcy court. Check this column for updates on any chances of warranty or service support for Storm products.



Storm's TotalScan Express

"Even if you could find Storm's new TotalScan Express USB and Parallel scanner, you don't want to buy it until you can establish there's support."

WATCHDOG UPDATE: STARGATE 2000

You may remember Jason Dickinson's problems with Computer-Star (now STARGATE 2000) from the January 1999 issue of Maximum PC. Dickinson was in a dispute with Stargate 2000 over a system he says never worked. Since then, Stargate 2000 has had a few problems with another bureau besides the BBB—the Federal Bureau of Investigation. The Cleveland FBI office arrested Igor Abramovsky on suspicion of extortion, mail fraud, and making false statements. Abramovsky, and or his company, allegedly failed to fill phone orders or sent shoddy equipment to customers. When customers called to get refunds, they were allegedly threatened and harassed, according to the

ILLUSTRATION BY SCOTT LAUMANN

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FBI. FBI agents, and agents with the INS, IRS, and U.S. Customs, searched the Stargate 2000 offices, as well. An employee told The Dog Abramovsky wasn't the owner. The FBI says otherwise.

MATROX FESSES UP

MATROX promises to address a groundswell of customer complaints regarding sluggish technical support and customer service, and the infamous missing ICD. Company spokeswoman Debbie Hynes said the problems are attributable to phenomenal growth and a restructuring that moved production overseas. As reported in Watchdog Online, Hynes said Matrox has pledged to double its support staff, increase hours from 8 a.m. to 8 p.m., and respond to all e-mail within 24 hours. Matrox pledges to have this done by April 1. The company also plans to eventually cut the average time on hold from 30 minutes to three minutes. Some readers questioned Matrox's ability to survive these tough times. Hynes said Matrox is doing well in sales, it's just taking time to ramp up support to match it.

Matrox G200

"When it filed for Chapter 11 bankruptcy, SyQuest said it would allocate a portion of the sale proceeds to provide warranty service"

SYQUEST BOWS OUT

DEAR DOG

I purchased a **SYQUEST SPARQ DRIVE** in February 1998 and recently began having troubles. I was able to contact SyQuest tech support through e-mail. After several e-mails, it was determined that my drive would need to be returned for service. On October 19, 1998, I sent the drive back to SyQuest, but since then I've tried, unsuccessfully, to contact SyQuest. It seems SyQuest has fallen off the face of the earth. I have e-mailed SyQuest Tech support (where I used to get immediate response), but to no avail. I've even tried to access its web site, but it seems to have gone to cyber heaven. I have run out of options and can't seem to find out what happened to my drive. Please help.

—Hiroki Okamoto

SyQuest SparQ

DEAR DOG I'm so angry, I could spit nails. However, I will stick to the issues.

I purchased and had good service for a short while for my **SYJET** drive, but learned there were damaged sectors on my main disk. I then bought a new disk. After I started using it, I discovered that it, too, had "damaged sectors."

I wrote to SyQuest. Got no answer.

My drive stopped working entirely. I contacted SyQuest, finally, and got the procedure to send the drive and two damaged disks back to them. Within three weeks from my having sent it to them, I heard they went belly up.

Is SyQuest still honoring its product, and is there any chance something can be done to expedite getting my drive replaced? I like the drive and can live with SyQuest being out of business if they were to send me a new drive (and I would hope that I never have another problem with it). I'm willing to take the gamble on that if there were some way to get my drive and two disks replaced with new equipment.

—Michele Vicari

Oh boy. Of the hundreds, nay thousands, of letters THE DOG has received recently, SyQuest complaints and concerns were at the top of the pile. SyQuest owned more than 35% of the removable storage market before it choked on the big bone, and most of the news at this time, unfortunately, isn't very encouraging.

When SyQuest filed for Chapter 11 bankruptcy in mid-November, the company initiated proceedings to sell its patents, intellectual property, manufacturing equipment, and raw materials to an undisclosed buyer. At that time, SyQuest said it would allocate a portion of the sale proceeds to provide warranty service for products already sold, with the new buyer providing customer support and warranty service for any SyQuest products sold in the future. But at press time, the identity of the buyer and a date when the deal would be signed, sealed, and delivered were still unknown.

Attorney Tobias Keller, who is overseeing the bankruptcy case, said part of the negations include how the unnamed company would handle warranty and repair issues.

"It's not so much a question of whether there will be warranties, it's a question of how," Keller said.

Keller said the company is also trying to figure out to handle the return of drives that were in for repair when SyQuest closed its doors. Drives returned for repair are still technically the property of consumers. Keller said he assumes the property will be returned, but the issues of how hadn't been settled at press time.

Many of you also wrote to THE DOG inquiring about missing rebates. Unfortunately, you'll have to get in line with all of SyQuest's other creditors. However, since SyQuest hasn't yet filed for Chapter 7, don't hold your breath.

Finally, for all of you who think SyQuest's woes translate into getting a good retail deal on SyQuest drives, think again. Sure, the drives may now be at bargain basement prices, but without customer and warranty support, that cash investment you make today may truly be disposable—as in trash—in the future.

Got a bone to pick with a vendor? Get spiked by a fly-by-night operation? Sic the Dog on them by writing watchdog @maximumpc.com. The Dog promises to get to as many as possible, but has only four paws to work with.

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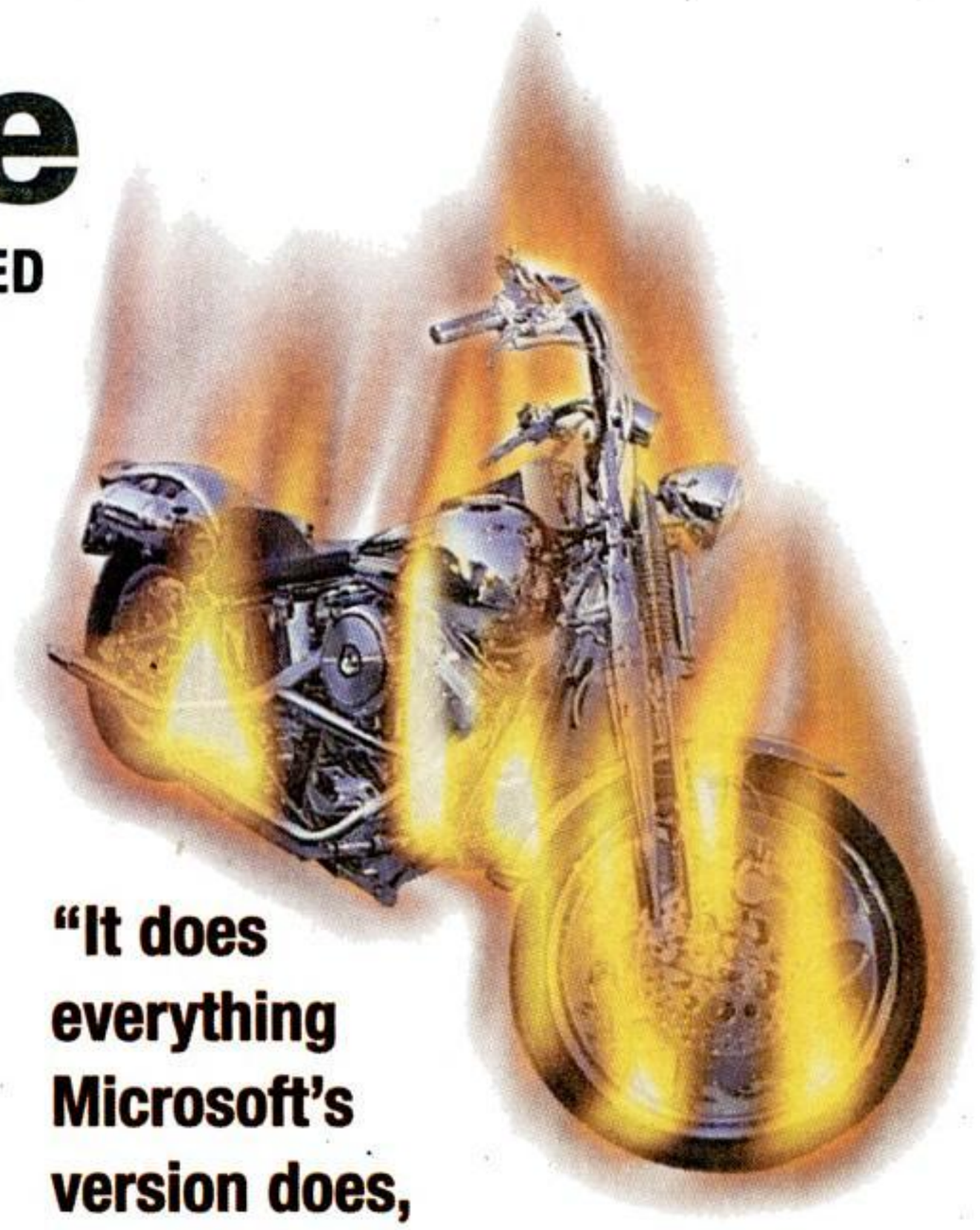
PURE PC POWER boot

boot REPORT

INSIDE TECH FOR ADVANCED PC OWNERS

Chromicide

CHROMEFFECTS DEATH GREATLY EXAGGERATED



"It does everything Microsoft's version does, only without the bloat."

It has all the makings of an episode of *Murder, She Wrote*. Only there's no smoking gun. And no one's found a body. And, for that matter, no one's reported anyone missing. So, who's the possible victim and who's the culprit?

Last July—at the Siggraph tradeshow, Microsoft unveiled "Chromeffects," a new technology that, according to Eric Engstrom (the Microsoft General Manager in charge of the project at the time) promised to "make every picture or piece of HTML text exist in a 3D space." It accomplished this lofty goal by taking the load off the constricted online pipeline and placing the burden of rendering multimedia objects on the client side. The only drawback was that the solution would require high-end hardware (350MHz P-II and beyond) and would be available only as an OEM value-add.

Everyone who saw the promising young technology was impressed by its revolutionary upside.

Then, against all Microsoft tradition, Chromeffects was on schedule to ship early! In an interview in the November 1998 issue of *Maximum PC*, Engstrom told us: "We were able to bring the schedule in dramatically. The development team didn't want to miss the Christmas OEM cycle."

Microsoft defector Alex St. John, who worked with Engstrom on the creation of both Chromeffects and the DirectX core that the technology tapped, was once again working closely with Microsoft. His new start-up company, Wild Tangent, was creating Chromeffects technology demos and working to garner developer support.

Then, on the heels of Intel's controversial testimony at the DOJ's anti-trust trial against Microsoft, reports filtered out that the Redmond giant may have killed the technology completely. Microsoft didn't actually confess to the murder via a corporate press release, but communicated the nefarious deed in a letter to its OEMs and potential developers. "We're stepping back and refactoring the Chromeffects technologies to better meet customer and development needs, and will instead release Chromeffects in multiple phases," said the letter. And Engstrom was transferred to another department within the company.

Without missing a beat, St. John switched his company's work to developing Java-based XML technology that mirrored Chromeffects. "It does everything Microsoft's version does, only without the bloat," he said to *Maximum PC*, "so ours is much faster than Microsoft's original implementation." Demonstrations of St. John's version on stock browsers at our offices backed up that claim.

The situation is not so clear cut. "Chromeffects is not dead," emphasized Rob Bennett, Microsoft's group product manager. "After we released the SDK last summer, we realized there were a few key areas we needed to attack before we could release the first final version." Bennett contends developers were concerned with issues such as driver stability and weak development tools. "We're trying to deliver a technology that will feed people's needs," he said. "Sometimes that means you take a step back and nail everything for version one."

In the meantime, Microsoft has decided to release some of Chromeffects underlying technologies in upcoming versions of *Internet Explorer* and DirectX. As for the XML bridge between the Internet and your PC's multimedia hardware, some of Chromeffects enabling technologies will be incorporated into Windows 2000, but Bennett doesn't believe the actual bridge will be one of them. "Based on the timing, it will probably ship with a later version of Windows."

And what about those rumors that Microsoft shelved Chromeffects to get back at Intel? "That is completely untrue," said Bennett. "Our decision was made completely independently of the DOJ investigation."

Chromeffects, as originally proposed by Microsoft may not be dead, but you'd never know that by reading the autopsy report.

—Bryan Del Rizzo

ILLUSTRATION BY SHERRY MONARKO

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B6 ▶ **bootReview:** Medea RaidArray

B7 ▶ **bootReview:** E-mu Soundcard

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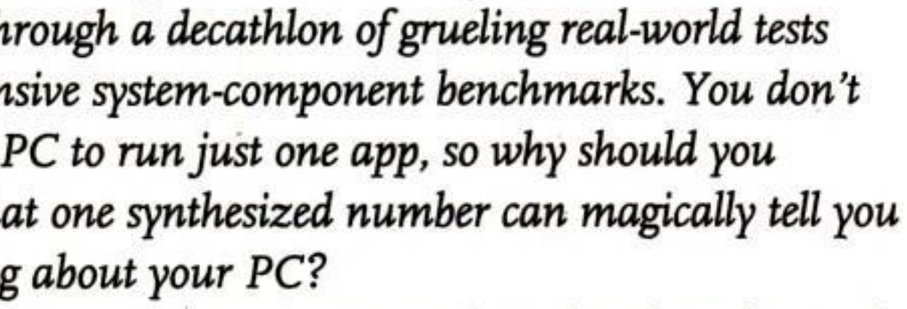
12–STEP

Benchmarking

There's no all-encompassing test that can tell you whether a computer system is good. Anyone telling you otherwise is a fool. That's why Maximum PC *puts each machine it reviews through a decathlon of grueling real-world tests and extensive system-component benchmarks. You don't use your PC to run just one app, so why should you believe that one synthesized number can magically tell you everything about your PC?*

Our testing suite combines synthetic benchmarks, such as Symantec's System Information/bootMark, *with real-world games, apps, and results you can relate to. No one cares about how many millions of bungholio-marks a PC gets, but tell someone a box does 100fps at 800x600 in* Quake II *and you'll get some saliva glands working. So take twelve steps in the tattered boots of a* Maximum PC *editor and learn the intricate art of benchmarking a desktop computer system.*

—Andrew Sanchez



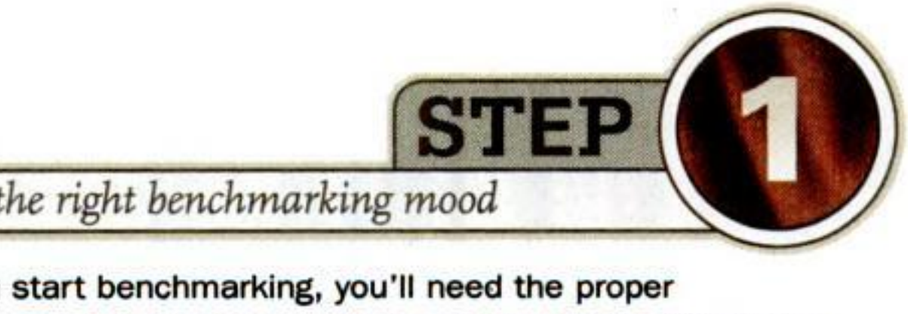
STEP 1

Setting the right benchmarking mood

Before you start benchmarking, you'll need the proper tools for the task: a stopwatch, copies of the appropriate benchmarking software, and the latest copy of DirectX (currently 6.1).

Make sure you're running all the latest drivers for all your installed hardware. High on the updated driver priority list should be videocards, SCSI adapters, EIDE controllers, and the latest motherboard BIOS firmware.

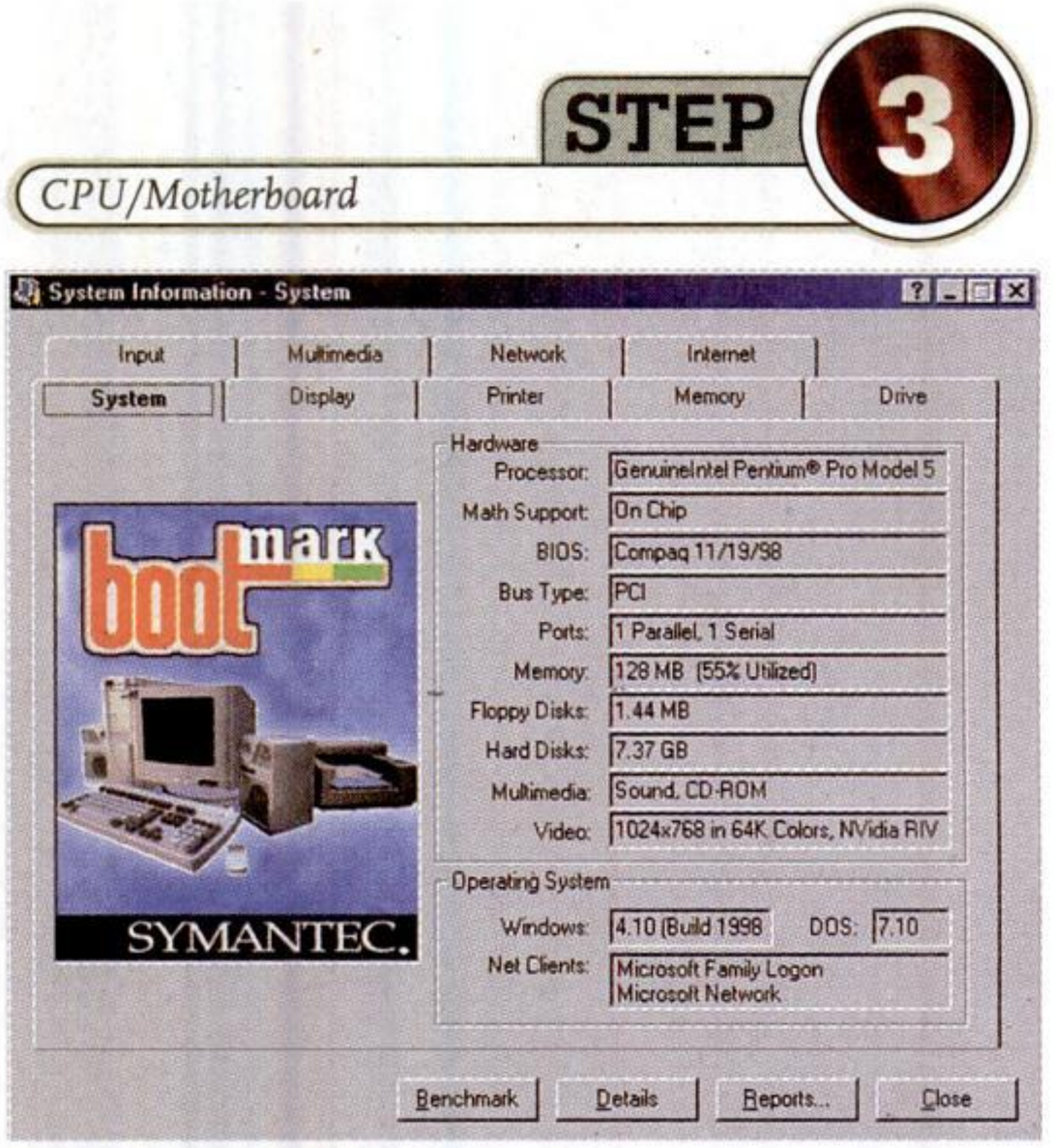
When we test machines, the desktop resolution is always set to 1024x768, the color depth is 16-bit, and the monitor refresh rate is 75Hz. If you have a dedicated 3D card such as a 3Dfx Voodoo^2, setting all your refresh rates as high as possible alleviates any bottlenecks you may encounter from videocard syncing its framerates with the vertical refresh rate.



STEP 2

Boot Up/Shut Down

The first thing we do is time how long it takes for a computer to start up and shut down. To do this, just start your stopwatch at the same time you hit the power switch. Stop the watch the moment you're in Windows and the hourglass cursor disappears. This is the system's **boot** time. Reset the watch and shut down Windows from the Start menu. Start the watch the exact second you hit the OK button. Stop the watch when the screen says "It's Now Safe To Turn Off Your Computer" or when the screen turns black. This is the **down** time.

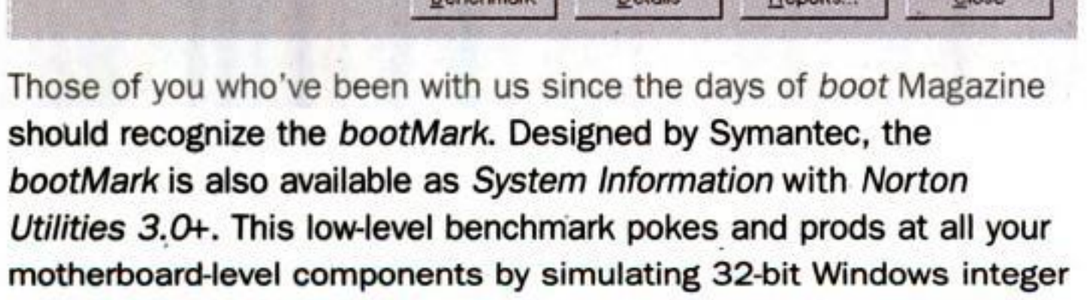


STEP 3

CPU/Motherboard

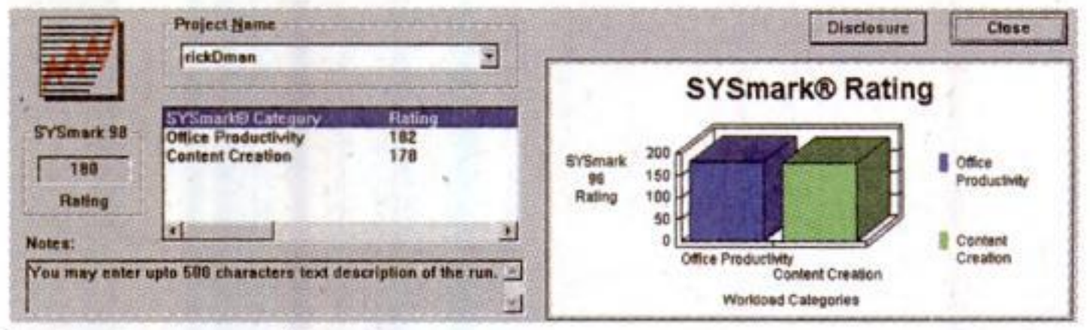
Those of you who've been with us since the days of *boot* Magazine should recognize the *bootMark*. Designed by Symantec, the *bootMark* is also available as *System Information* with *Norton Utilities 3.0*+. This low-level benchmark pokes and prods at all your motherboard-level components by simulating 32-bit Windows integer computations. Components subjected to *bootMark*'s thrashing include the CPU, L1 and L2 cache, system memory, and core-logic chipset, and how they all work together. BIOS settings can nudge *bootMark* results around, so be careful how you set them.

We run the *bootMark* at least five times, to ensure a consistent score. Once the benchmark settles down, we record the official *bootMark*.



STEP 4

Windows Apps



Our longest benchmarking torture session involves BAPCO's *SYSmark 98*, a comprehensive suite of script-based real-world applications that tests overall Windows 98 application performance. Applications include not only spreadsheet (*Excel 97*), word-processing (*Word 97*), and 2D-graphics apps (*CorelDRAW 8.0*), but also 3D rendering (*Bryce 2.0*), Internet content creation (*Netscape 4.05*), speech recognition (*Dragon Systems*

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REAL WORLD BENCHMARKING				
CPU/MOTHERBOARD bootMark	250	100	175	250
WINDOWS APPS SYSmark 98 official score	600	50 official score	150	150
HARD DRIVE HD Tach MB/sec	18	1 MB/second	9	18
CD-ROM CD Tach98 drive rating	40	10x drive rating	20x	40x
3D RENDERING Newtek Inspire3D sec	10	1000 seconds	500	10
DESKTOP PUBLISHING Adobe Photoshop 5.0 sec	45	105 seconds	75	45
DIRECT3D ForsakenMark fps	110	10 frames-per-second	60	110
OPENGL Quake2 v3.15 fps	110	10 frames-per-second	60	110

To see how well your PC stacks up against what we consider da bomb, compare your scores against our range chart. The closer you are to the right, the more bad-ass your box is.

NaturallySpeaking 2.02), optical character recognition (*OmniPage Pro 8.0*), and video editing (*Premiere 4.2*).

The latest version differs from the older *SYSmark32* by splitting up the benchmarking into two distinct suites—one for integer performance and one for floating-point processing. *SYSmark 98* stresses the CPU, memory, hard drive, and videocard driver subsystems.

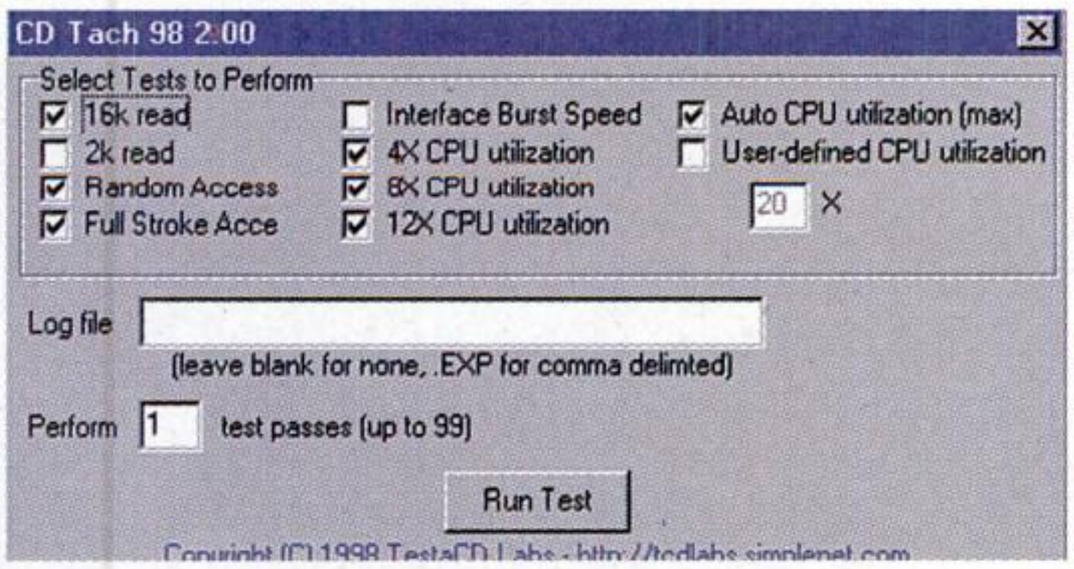
After the big benchmarking brouhaha, *SYSmark 98* displays how well your PC performed in each category via a numerical score and spits out an Official Run Rating score, which we use in the review—the higher the score the better the PC.

STEP 5
Hard Drive

TestaLabs' *HD Tach* is a low-level hard drive benchmark that tests read and write throughput (in the unregistered version, only the read option is enabled), random access times, CPU utilization, and read burst speeds. *HD Tach* bypasses cache settings to really stress a drive's mechanical performance.

We report the drive's read speed (measured in MB/sec).

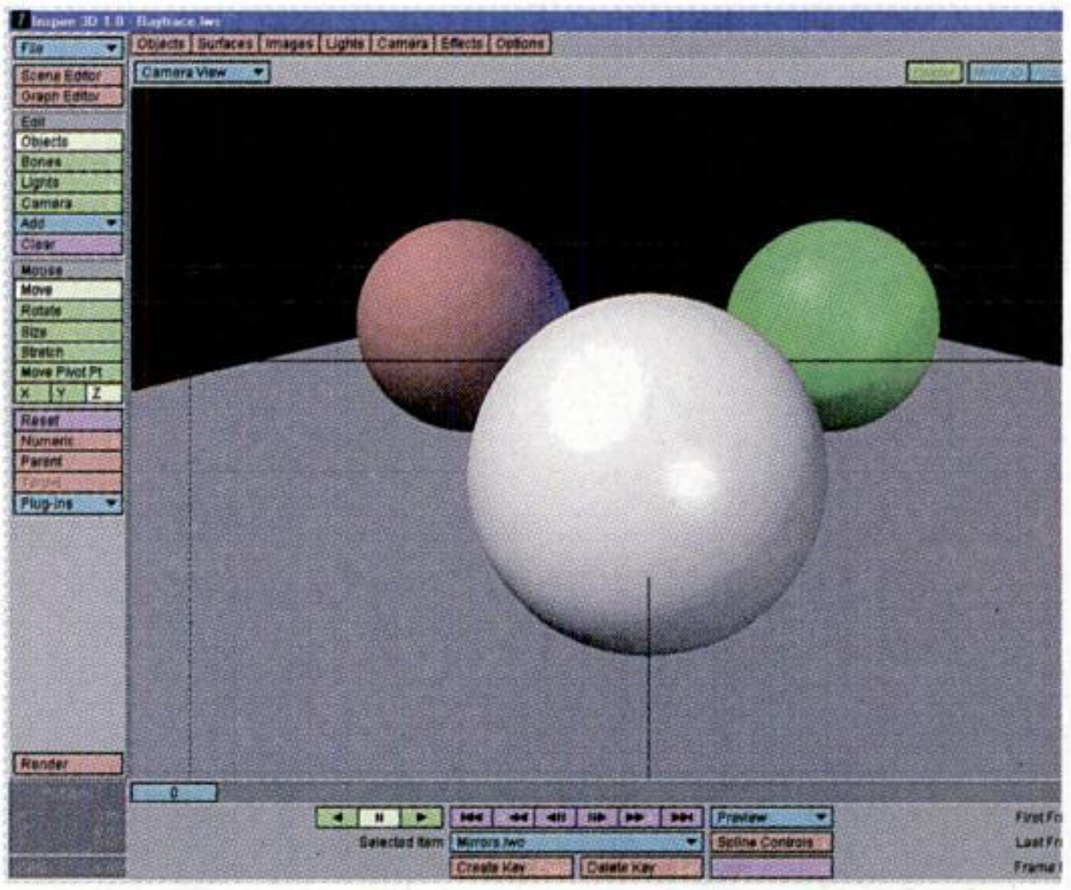
STEP 6
CD-ROM



Once again, TestaLabs provides the benchmarking software in the form of *CD Tach 98*. This low-level benchmark thrashes a CD-ROM or DVD-ROM drive to check data-transfer speeds, access times, and CPU utilization.

We report the drive rating of the CD-ROM drive, which is a score derived from a weighted average of the inner, center, and outer read speeds (the weighting is dependent on whether it's a CAV or CLV drive). This is expressed as a multiple of the 150K/sec (or 1x) score of first-gen CD-ROM drives, so a rating of 12x means the CD-ROM drive pumps out 12 x 150K/sec average data-transfer performance.

STEP 7
3D Rendering



3D rendering is an excellent test of the CPU's floating-point processor and the most intensive operation you can perform with your PC. It takes polygon and scene data, processes all of it, and then throws it at your videocard for final rendering.

The 3D-rendering software we test with, NewTek's *Inspire3D*, is a watered-down version of the highly prized *Lightwave3D* modeling and animation program. The only thing *Inspire3D* can't do is render output past 640x480 resolution. Unlike realtime games such as *Quake II*, scenes created by Inspire3D are composed of millions of polygons using large, high-resolution textures (1024x1024 on up), a variety of processor-punching special effects such as radiosity lighting and shadows, as well as reflective environment mapping.

For our testing, we use the RAYTRACE.LWS file that ships with *Inspire3D*. As the name suggests, this scene is filled with high-polygon-count spheres, raytraced shadows, reflective mapping, and shading galore. It's a real CPU-buster, so expect a single frame to take a good few minutes to render.

We report the time it takes a system to render one frame of animation (measured in seconds).

STEP 8
Desktop Publishing

Adobe's *Photoshop 5.0* comes to bat for our desktop-publishing benchmark. Via a scripted set of commands that applies filters and other adjustments to a high-res graphics file, *Photoshop* tests computer subsystems, including CPU, MMX processing, video-

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card driver speed, memory, and hard drive throughput. Memory is the biggest contributor to an excellent *Photoshop* benchmark.

In this test, you'll need a stopwatch. Just start the timer once you launch the Maximum PC test.ATN script (which can be found on the Maximum CD or downloaded from **www.maximumpc.com**) and stop timing as soon as the script finishes. The official Desktop Publishing benchmark is reported in seconds.

STEP 9

Installing DirectX

Microsoft's much-maligned API is finally getting some respect. With DirectX5 and DX6, Direct3D is seeing some really awesome games come piping through its layer. Gone are the crappy *Terracide*, *Monster Truck Madness*, and *Hellbender*. Now we're cooking with big-name behemoths such as *Forsaken*, *Incoming*, *Turok*, *Heavy Gear II*, *Thief: The Dark Project*, *WWII Fighters*, and countless others. Proving once and for all you don't need 3Dfx in order to get awesome visual effects such as colored lighting, bump-mapping, and multitexturing, D3D is a force to be reckoned with.

You'll need to install the latest version of DirectX for the last two benchmarks, since they stress all your multimedia components. You'll also need to tweak your videocard settings before proceeding. For these last two tests, refresh rates are set as high as possible and no features is disabled. Do *not* disable V-Sync.

STEP 10

Direct3D

We use a special version of Acclaim's *Forsaken* to stress your 3D accelerator. A single-pass rendering game, *Forsaken* judiciously uses colored lighting, alpha-blended effects, and lots of weapon effects to ensure your D3D card gets a good working. It's also a great test for checking alpha-blending problems and texture format support.

In our scripted benchmark level, roughly 2MB of textures are used, so unless your videocard does dedicated AGP direct memory execution (such as Intel's i740), your videocard should be able to fit all textures into local video memory.

Benchmarking takes place at 800x600 and 16-bit color. The higher the *Forsaken* score the better. We don't report 640x480 results because, quite frankly, we know all videocards can hit triple-digit framerates at this res, and we're tired of it. At the end of the scripted run, we take the average frames-per-second *ForsakenMark* produces and use this in our test results.

Feel free to run the benchmark at higher resolutions to test your videocard's fill rate-the benchmark will go as high as your video subsystem will allow.

STEP 11

OpenGL

id's venerated *Quake II* is the last battlefield on which a system fights. A first-person shooter that taxes a CPU's floating-point processing, *Quake II* supports OpenGL and multitexturing, making this the ideal benchmark for checking how well a system plays games. We use id's DEMO2.DM2 file for testing. Keep an eye out for abnormal lighting effects, messed up alpha-blending, or missing textures.

After setting up your system to its proper graphic options, press the tilde key (~) to pull down the console. Now, type in timedemo 1 at the console and hit Enter. Then, type in demomap demo2.dm2 and press Enter. This will clear the console and start the benchmark. After it finishes, you'll get the average frames-per-second. Now, press the Up Arrow key. This automatically re-types the last command entered on the console—in this case, DEMOMAP DEMO2.DM2. Then press Enter. This will re-run the benchmark. You should run the benchmark a good five to ten times, as the test will slowly but surely spew out a consistent score. Record that settled-down score.

QUAKE II BENCHMARK SETTINGS

Everyone uses Quake II under different testing conditions, so here's our testing parameters:

UNDER VIDEO

Driver	3Dfx OpenGL (for Voodoo cards), default OpenGL (for everyone else)
Video mode	800x600
Screen size slider	all the way to the right
Fullscreen	yes
Texture quality slider	all the way to the right
8-bit textures	no
Sync every frame	no Under Options:
CD music	enabled
Sound quality	low (default)
Sound quality	max compatibility (default)

We don't disable sound, network, or anything else. This is to simulate a real-world gaming experience. We're not trying to isolate the videocard—we want to see how well this works within the context of the entire system.

STEP 12

What to do with all the numbers

Coming up with benchmarks that'll poke each section of a computer is no small feat. And while we can benchmark ad nauseum to find how each little subsystem that makes up your PC performs, we decided that pistol-whipping these systems with the apps you use everyday is a more useful gauge a PC's abilities.

Tweak your system after running the benchmarks to see if you can squeeze more performance. Little things like overclocking and disabling V-Sync can make the difference.

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Learning to Code

One of the biggest differences between the PC enthusiasts of today and those of 15 to 20 years ago is that almost nobody programs their own computer anymore. That's a shame. Because it helps you understand how your machine really works, programming gives you a sense of control and technical mastery that mere users can't imagine.

While programming is an exacting and demanding discipline, modern development tools make it much easier to put together complex programs. Today's visual-dev tools let you graphically design a user interface by dragging and dropping icons. When you're done, the dev tool automatically writes much of the code for you, saving hours of tedious work and allowing you to focus on the real guts of your program.

When learning to program, you'll start with simple example programs, but if you stick with it, eventually you'll write useful programs for yourself, to give away, or even to sell. Programming isn't for everybody, but don't be surprised if you find it addictive.

—Tom R. Halfhill

Which Language is Best?

There are almost as many programming languages as human languages. Popular languages include C (used by pros to write commercial software), C++ (an extension of C), BASIC (originally designed for beginners, but now used by pros, too), Pascal (invented as a teaching language, but also used professionally), Java (a strong up-and-comer that's similar to C++), FORTRAN (for scientific computing), and COBOL (used mostly on mainframes).

BASIC and Pascal are relatively easy to learn, and excellent visual tools are available for both languages. I recommend Microsoft's Visual Basic or Inprise's Delphi (which is like "Visual Pascal"). Although professional versions of those tools cost $500 or more, you can get low-end versions for less than $100 that do everything you need.

If web development is your ambition, JavaScript is a good starting point. It's built into the most popular web browsers, so you don't need to buy any special tools. All you need is an introductory book and a working knowledge of HTML. Don't confuse JavaScript with Java. JavaScript is a scripting language designed by Netscape to add functionality to web pages. You can't write applets or real applications in JavaScript because it's not a full-fledged programming language, like Java is. The two languages are only superficially similar.

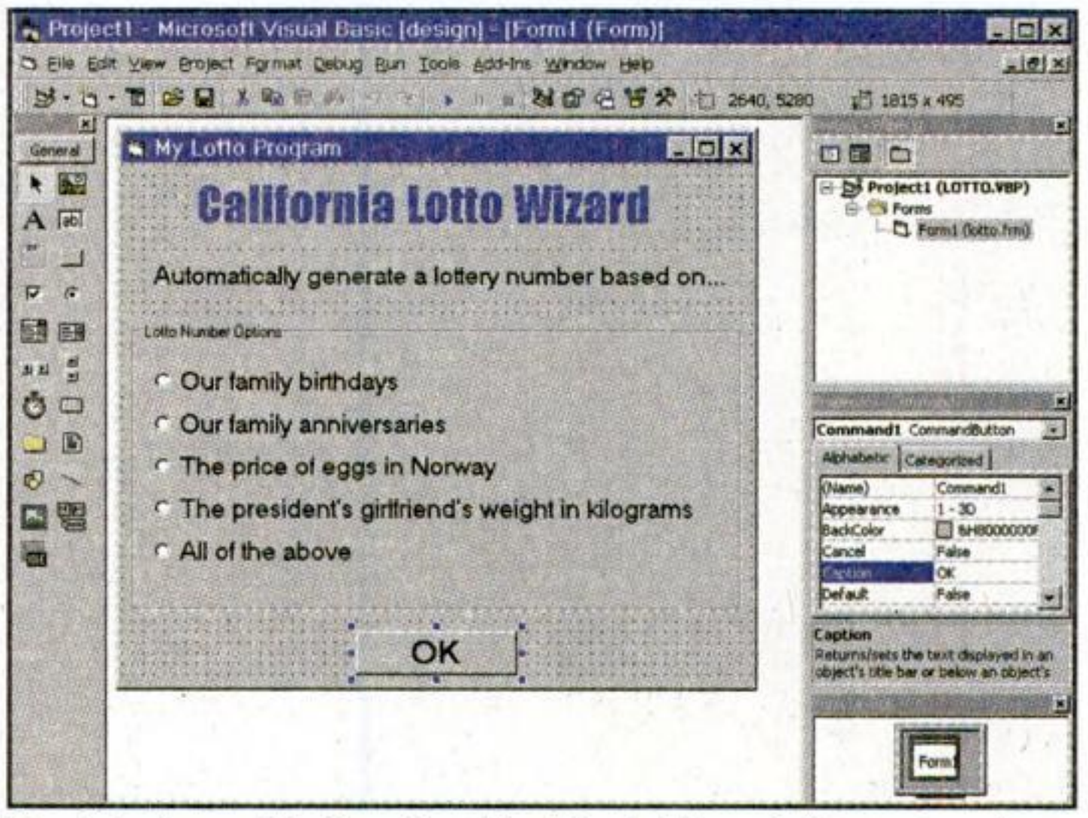
Writing Code

All programming is done in source code, which is the actual program instructions you type in a language such as BASIC or Pascal. But source code won't run on a computer. Your dev tool includes a compiler that converts source code into object code (also known as executable code, machine code, or binary code). Although it's possible to write a program directly in machine code, it's extremely difficult and rarely done today.

Programming languages have strict rules of spelling and syntax. Even the tiniest mistake in your source code will trigger a compiler error or cause incorrect results when your program runs. Dev tools try to catch errors and suggest corrections, but they can't read your mind. Ultimately, you have to find and fix the errors yourself. It'll give you a new appreciation for bug-free software.

Beginners are often dismayed to discover that a single line of code often doesn't do very much. It can take hundreds of lines to do something that appears trivial to nonprogrammers. I've written over 500 lines of code just to display a movable, resizable window with pull-down menus. That's why visual-dev tools are so important: they let you do the same thing without writing any code. It's foolhardy to write programs for today's PCs without them.

A visual tool can be thought of as a graphics app that generates most of your program's GUI code for you, so all you have to write is the code that does the real work of your program—such as calculating your checkbook balance. With a visual tool, you drag GUI components (windows, buttons, menus, text fields, etc.) from a tool palette and drop them onto a form that represents a window in your program. The compiler automatically generates all the code required to display the form as a functional window.



Visual development tools such as Visual Basic let you design programs by dragging and dropping components from a tool palette onto a form.

Some fundamental structures are common to virtually all programming languages. These include variables, arrays, branches, loops, and subroutines. After mastering these basics, you'll be able to switch languages fairly easily.

Variables are names that represent values stored in memory. Different languages have different rules for assigning variable names, but generally you can pick any name. You could declare a variable named `jan_sales` to hold the dollar amount of company sales in January. Variables allow you to manipulate values in numerous ways. For instance, you could tally up the first-quarter sales like this:

```
Q1_sales = jan_sales + feb_sales + mar_sales
```

If `jan_sales` is $10,000 and `feb_sales` is $11,000 and `mar_sales` is $12,000, then `Q1_sales` would equal $33,000 after the computer executes this statement. Variables can represent all kinds of numbers, as well as strings of characters, such as a person's name.

Arrays are special variables that hold a series of related values. In the above example, it would make more sense to

story continued on page B8

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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Medéa VideoRaid

EIDE disk arrays for desktop video

Medéa's new line of VideoRaid disk arrays is accomplishing the unlikely task of matching the performance of Fast and Wide SCSI drives with the prices of IDE drives and enticing desktop video producers in the process.

Building on the new Ultra ATA technology that has bumped IDE disk performance up to that of SCSI disks (burst transfer rates of up to 33MB/sec), Medéa has added a couple of new tricks to make Ultra ATA disks stand up to the rigors of capturing, editing, and outputting video.

THE SPECS

RECOMMENDED

- Pentium
- Open PCI slot (for VideoRaid PCI)
- Onboard EIDE controller and 3.5-inch or 5.5-inch drive bay @ 2.6-inch high (for VideoRaid si)
- Windows 95 or NT
- Video-capture board
- Video-editing software
- Analog or DV deck/ camcorder

PLUSES

- Sustained data-capture rates up to 15MB/ second
- 10GB of storage
- Isochronous data transfer ensures no dropped frames
- Simple installation
- Expansion by daisy-chaining
- No SCSI device IDs to deal with

MINUSES

- Expensive compared with new UDMA hard drives

Medéa's Zone-Mapping Technology (ZMT) performs a comprehensive check of each disk and certifies that it is free of surface defects that would otherwise degrade video capture. Further, its Zone Striping Technology (ZST) stabilizes data transfer rates. Normally, a hard disk writes data to its outer tracks at faster rates than to its inner tracks, and at unpredictable times. Medéa's ZST firmware writes data simultaneously to both outer and inner tracks of the disks in the array, ensuring that data transfer occurs at an isochronous (regular over time) rate. This stability, combined with the speed of Ultra ATA and a cost of about $100 per gigabyte, is enticing to video producers used to paying three to four times that for SCSI.

The VideoRaid PCI is an 8.6GB two-drive external array offering sustained data transfer rates of 15MB/sec and storage for up to 17 minutes of video compressed at a 2.5:1 ratio. The array connects via a PCI host adapter that the PC thinks is a SCSI port, but has no device IDs, terminators, or other SCSI difficulties. You can also daisy-chain a second identical array to this unit to achieve a 27MB/second data transfer, enough to support even a dual-stream, realtime effects board. Medéa claims you can chain up to two terabytes of storage onto one adapter.

The VideoRaid PCI contains two Quantum Eclipse EXs, which Medéa chose after extensive qualification showed they performed the best.

We tested the VideoRaid PCI using Pinnacle Systems' miro DC50, which captures professional-quality video at rates up to 7.18MB/sec. Interestingly, the Pinnacle utility for testing a system's transfer rates indicated the DC50's highest rate was "probably too fast" for the Medéa array, though it OK'd its next-fastest rate (7.07MB/sec).

We set the system to the top rate and captured more than an hour of several video clips in Adobe *Premiere 4.2*. The system performed flawlessly. We ran a movie analysis on each clip and found that it all came in at the designated quality with no dropped frames. *Premiere* also graphed our captures consistently at around 7.1MB/sec. After editing the video, we played it out to tape at the identical rate and again had no problems.

What separates Medéa's VideoRaid from competing IDE drive-striping solutions is its ZST, which enables the drives to sustain a high data rate from the first gig to the last.

This array installed easily and performed exceptionally well across the board. Medéa's VideoRaid represents a great deal for desktop video editors at any level.

—Tim Tully

boot VERDICT

Price $1,299 (8.6GB configuration)
Company Medéa
Phone 818.597.7645
URL www.medeacorp.com

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THE VIDEORAID SI INTERNAL VIDEO ARRAY

Medéa also offers a family of internal VideoRaid products whose lower costs bring even better price/performance ratios to desktop video.

The VideoRaid si comes in three configurations—10GB, 16.8GB, or 23GB of storage. We tested the 10GB unit ($999), which is configured with two Maxtor Diamond Max drives, and provides storage of up to 17 minutes of video at a 2.5:1 compression ratio.

This unit attaches to the PC's internal EIDE cable and requires a technically more involved installation—including configuring the BIOS—than the external array. Nonetheless, the complete installation was performed painlessly by Medéa's install software. The internal array can also attach to additional arrays to expand storage and increase data transfer rates.

The performance of the si Internal matched its external counterpart, capturing video at rates averaging between 7.1 and 7.3MB/sec, and providing completely reliable playback and output to tape.

The Medéa VideoRaid si Internal gives you excellent data transfer performance and expandable storage while taking no space on your desktop.

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E-mu Audio Production Studio

It coulda been a contenda

As a result of its acquisition of two of the top names in professional audio, Ensoniq and E-Mu, Creative Labs now dominates the pro-music scene. It's too bad, then, that Creative's new E-Mu division couldn't come up with a better pro-level soundcard than the Audio Production Studio.

In an aggressive first round, the APS came out swinging with a one-two combo PCI E-Card and 5.25-inch E-Drive that snuggles into the front of your PC. The E-Drive sports a total of six balanced 1/4-inch jacks and quad S/PDIF RCA-style in/out ports, plus a 1/4-inch headphone jack and dedicated gain pots with 20db pads. E-Mu has raised the bar by tossing in the new 1,000MIPS EMU 10K1 chip, trumping the traditional EMU8000. The APS can bellow out 64 voices of the latest SoundFont 2.1 technology, spanning two ports of 16 MIDI channels each. And condenser mikes with a thirst for power should be quenched by a 12-volt Phantom.

While many soundcards are limited by 2MB or 4MB of onboard RAM, the APS comes with a whopping 8MB of sounds and can load up to 32MB using system RAM across the PCI bus. No special SIMMs are required.

In round two, the APS really took a beating. Even though it has loads of I/O options, the APS allows you to record only two digital audio tracks simultaneously. This limitation is like a glass jaw for serious pros. Creative says the card is primarily a stereo sampling card and this shortcoming will be addressed in future driver upgrades. E-Mu also promises Windows NT support and hardware support for DirectX in future updates. The E-Control applet lacks activity LEDs, the ability to enter exact numeric values, and meters—barring the masters. Snapshots can be loaded and saved for effects and mixer setups, but there was no MIDI control at press time. Most people won't purchase an APS for gaming, but E-Mu precludes this by leaving out joystick, DOS SoundBlaster, EAX, and DirectSound3D support.

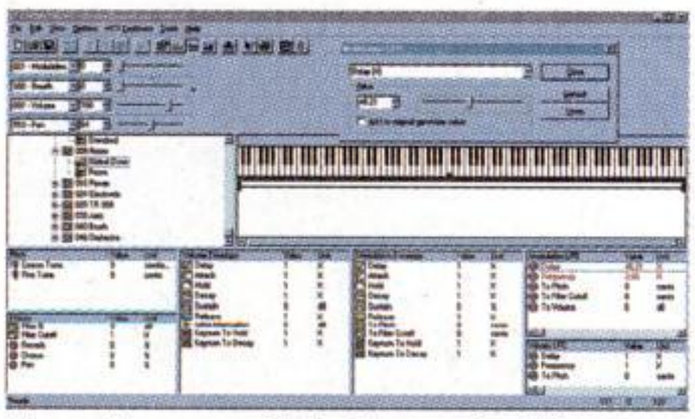
THE SPECS

RECOMMENDED

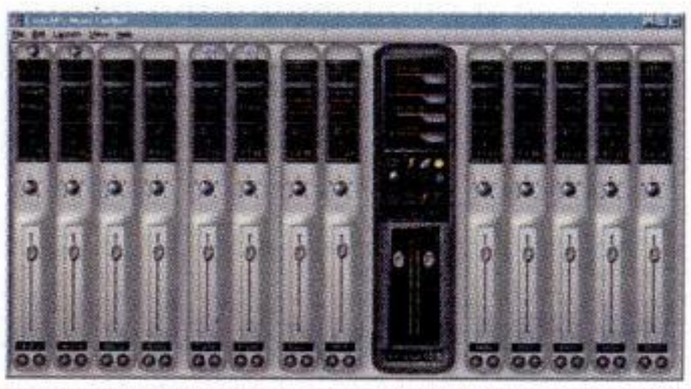
P200, 64MB, PCI slot, Windows95, 5.25-inch drive bay

BUNDLE

SoundFont Bank Manager and Librarian | Vienna SoundFont Editing Program | Cakewalk Express Gold | SoundForge 4.0 XP | 1,500 sounds

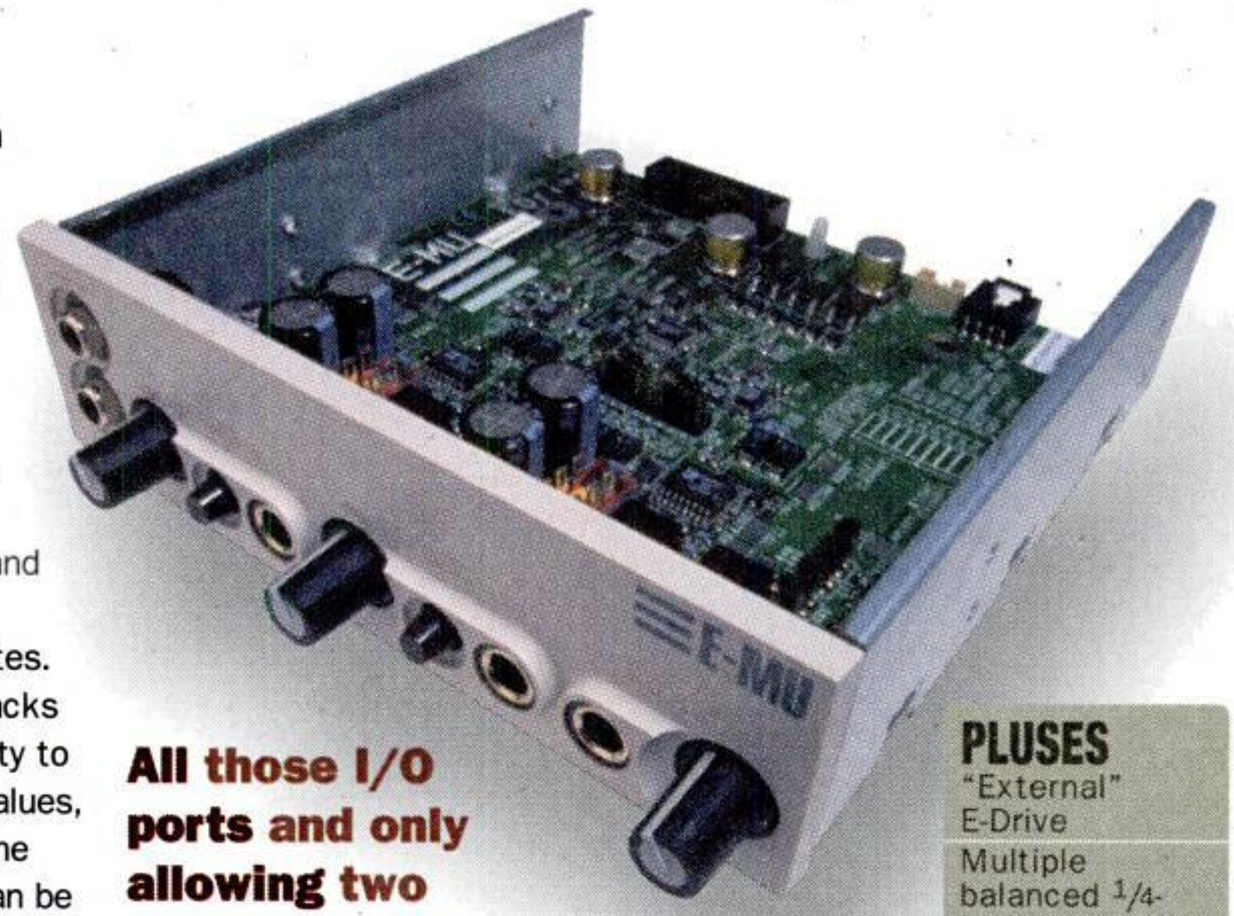


Vienna is a powerful tool for manipulating existing sounds or creating new sounds.



Those familiar with a real mixing board will feel right at home with the E-Console.

In the third and final round, the APS tries to make a comeback. Since SoundFonts are generated on the fly and piped through the 10K1, effects work on them as well. Consequently, each input strip features an insert, two effects sends (from a palette of four effects buses), volume, pan, mute, and solo. Plus, various routing options allow sub-mixer operation. Both MIDI and WAV audio are passed on through to the digital output for pristine recordings. Almost all number crunching is done on the card itself, so it doesn't wrestle the CPU for cycles, allowing the APS to run on a system with a lowly 166MHz Pentium.



All those I/O ports and only allowing two to be active at any time? Why not just bite a chunk of our ear instead?

The crippling blow was the realization that each effect is pulled from a pool and then ghosted out so it can't be used again. You can't, for example, use two different reverb settings on different strips. While the proprietary realtime effects are decent and can process incoming signals, they're not DirectX, so they can't be used by other programs. This, combined with E-Control's inability to load DirectX plug-ins, put the APS down on the canvas for good.

If we had to pick between an aging Turtle Beach Pinnacle or APS, the APS would win hands down. But unless E-Mu addresses its current blind spots, we think the APS will be confined to the welter-weights for now.

—Daevid Vincent

PLUSES

- "External" E-Drive
- Multiple balanced 1/4-inch outputs and mike/line inputs
- 12-volt phantom power
- 1/4-inch headphone output
- RCA S/PDIF I/O
- Uses up to 32MB of system RAM
- PCI 2.1-compliant card
- 64-voice SoundFont 2.1 over 32 MIDI channels
- Effects computed on EMU 10K1 chip

MINUSES

- Limited two input or output at a time
- Included effects are not DirectX
- No DirectX support on E-Control mixer
- Limited number of effects
- No WAV file samples
- No MIDI control of mixer or effects

boot VERDICT

Price $700
Company E-Mu/Creative Labs
Phone 408.438.1921
URL www.emu.com

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story continued from page B5

create an array variable named **monthly_sales()** and store each month's sales in a different slot of the array. You can access the different slots by using a number called an array index, so January sales would be stored in **monthly_sales(1)**, February sales in **monthly_sales(2)**, March sales in **monthly_sales(3)**, and so on.

Branches divert the flow of a program along two or more alternate paths:

```
if Q1_sales > 100000 then print "Good work!"
else print "Try harder next quarter!"
```

If first-quarter sales are greater than (>) $100,000, the program prints a congratulatory message; otherwise (the **else** clause) it displays words of encouragement. Incidentally, these program fragments are in BASIC, although **print** is an antiquated instruction that in a real program would be replaced with more elaborate code to display a message on the screen.

Loops are structures that repeat some program instructions a specified number of times, or until a certain condition is met:

```
for step=1 to 12
  annual_sales = annual_sales +
monthly_sales(step)
next step
```

Here, the variable **step** is a counter that starts at 1 and stops at 12. The middle statement inside the loop adds the value in the array variable **monthly_sales()** to the variable **annual_sales**. So during the first pass through the loop, the middle statement is the equivalent of this:

```
annual_sales = annual_sales + monthly_sales(1)
```

On the next pass through the loop, **step=2** so the value **monthly_sales(2)** is added to **annual_sales**. And so it goes until after the 12th pass, when the loop ends. This has the effect of adding **monthly_sales(1)** through **monthly_sales(12)** together and storing the result in **annual_sales**. Loops are great time savers.

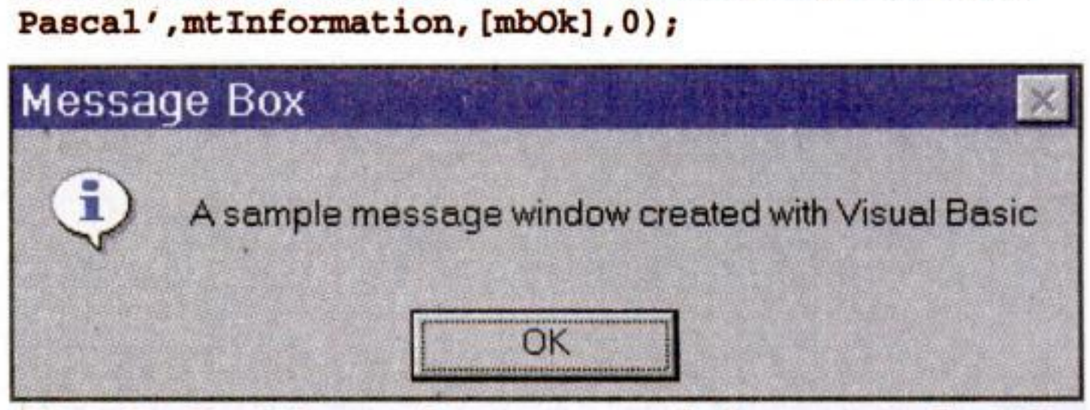
Subroutines are also known as functions, procedures, subprograms, and methods. If you need to repeatedly execute a block of instructions, you don't have to duplicate that block. Instead, you can group the instructions together in a subroutine and call it by name. You could create a subroutine named **SumAnnualSales** and call it whenever you need to calculate total sales for a year.

Modern operating systems and dev tools have vast libraries of subroutines known as application programming interfaces (APIs). APIs can help you do everything from drawing graphics to establishing a network connection. Visual-dev tools make heavy use of APIs behind the scenes. You can learn how to call these libraries by studying books and help files.

The dialogs below show how single-line calls to prewritten libraries display messages on the screen using three different programming languages. The items inside the parentheses of these program statements are parameters. They specify the text to display in the message window, the name to display on the window's title bar, and which icon to show in the window.

```
JOptionPane.showMessageDialog(null,"A sample
message window created with Java","Message Box",1);
```

```
MessageDlg('A sample message window created with
Pascal',mtInformation,[mbOk],0);
```




```
OK = MsgBox("A sample message window created with
Visual Basic",64,"Message Box")
```

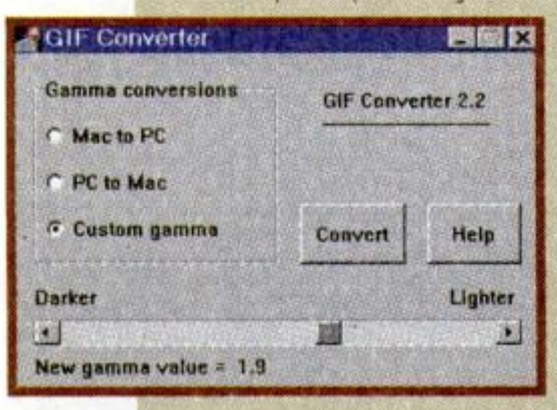
By calling APIs, you can get the operating system to do lots of work for you. Here are single-line calls in Java, Pascal, and Visual Basic that display messages on the screen.

I used a shortcut in the Java statement by referencing an object. C++, Visual Basic, Pascal, and other languages have all adopted some concepts of object-oriented programming (OOP), but Java takes it even further. You'll be in a good position to learn OOP after mastering the fundamentals.

Programming isn't difficult if you're reasonably patient and can think logically. Who knows, you may find it more fun than playing computer games. And when you finish a program, you have more to show for your sweat than a high score. b

A SIMPLE PROGRAM IN PASCAL

"GIF Converter" is a relatively simple program I wrote in Pascal using Delphi, a visual dev tool from Inprise (formerly Borland). My program lets you alter a GIF file's gamma value, which controls the brightness and contrast of the image.



GIF Converter is a sample home-grown program on this month's Maximum CD.

This is useful because Windows PCs and Macs usually have different screen gammas. GIF images created on a Mac often appear too dark when viewed on a Windows PC, and vice versa. Since many photographers and graphic artists use Macs to post GIFs on the web, it's nice to be able to adjust the images for Windows. You could do this with an image editor such as AdobePhotoshop, but not everyone has such a program, and my utility is more convenient.

I got the idea from a freeware program that converts GIF gammas. However, that program was a DOS command-line utility. I used Delphi to create a GUI for Windows, and I rewrote the original C source code in Pascal.

"GIF Converter" (for 32-bit Windows 95, 98, and NT) is on this month's Maximum CD, along with my Pascal source code. Open the source code with a text editor to see what's behind a program like this. Remember that Delphi wrote some of the code for me.

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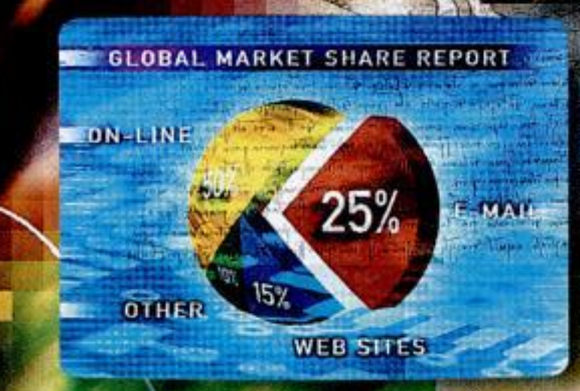

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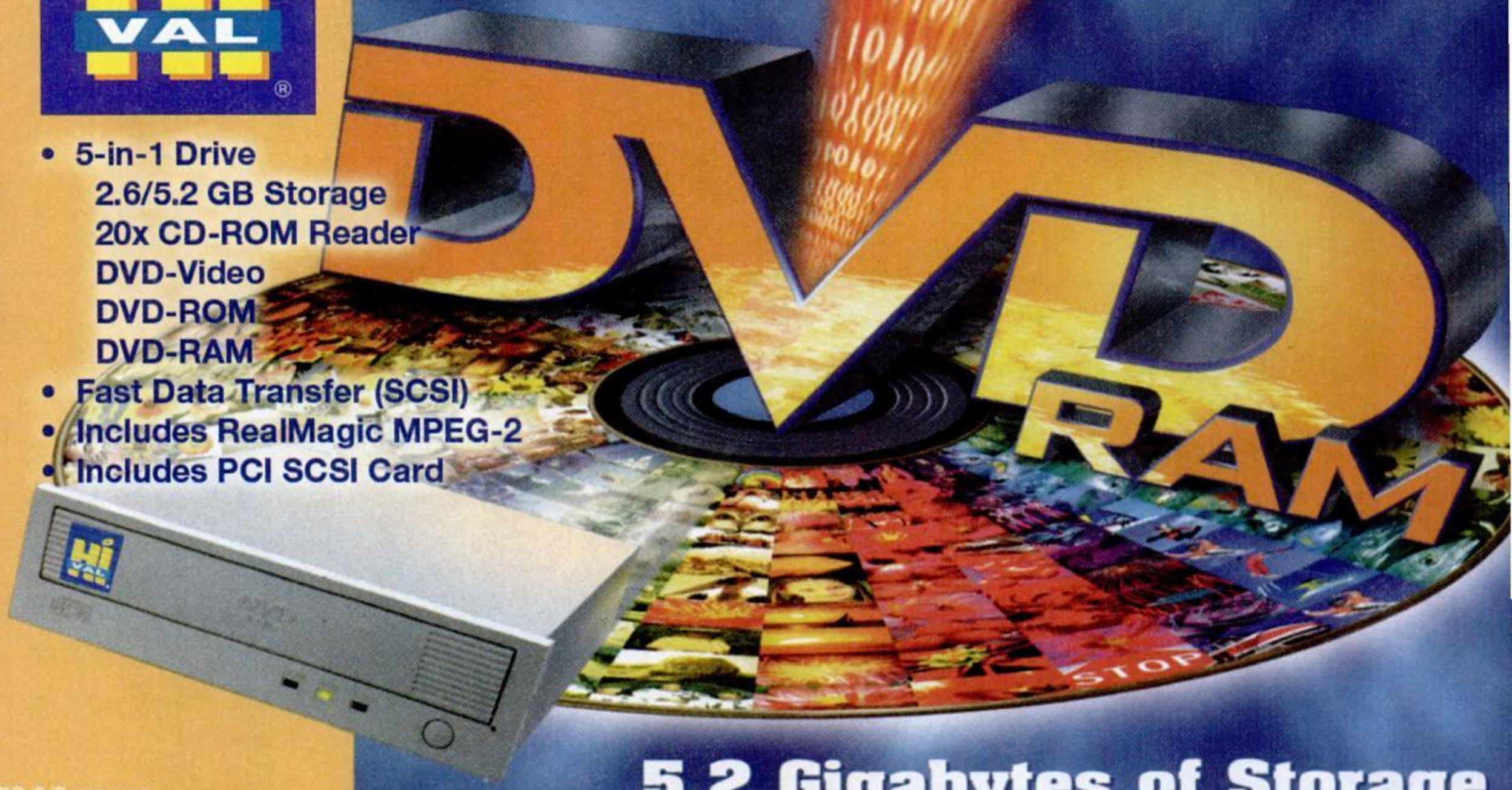

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PERIPHERALS

Ericsson SH 888

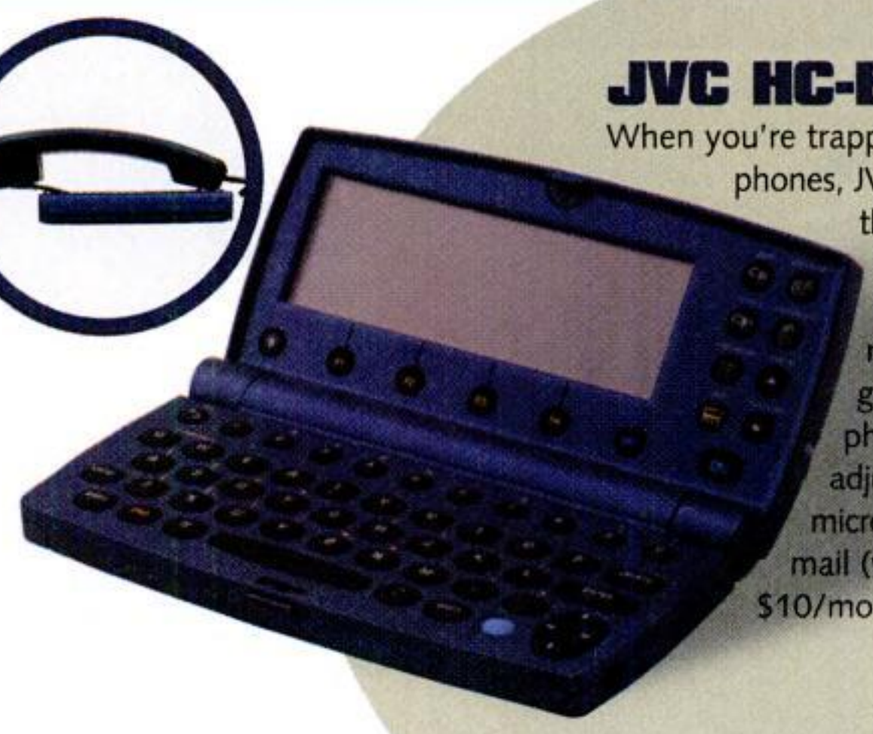
Ericsson touts the $499 SH 888 as its first GSM 900/1800 dual-band mobile phone, but what really puts the lust in our little hearts is the phone's wicked combo of built-in modem and infrared connection (located on the top right hand side of the phone). With the SH 888's IR connection, all you need do is place a call to your ISP or server, lay the phone down next to the IR port of your computer or PDA device (up to 36 inches away), and use the internal modem to check e-mail, browse the Internet, or send and receive faxes. No fuss, no muss. The SH 888 weighs 195 grams, measures 130x49x22mm (with Ultra Slim Battery that offers four hours talk time and 80 hours standby), and contains a retractable antenna. **Ericsson; www.ericsson.com; 800.374.2776**

Pfaff Creative 7570

This machine's modern European design and digital interface make sewing so simple, you can hardly *try* to make a mistake. The LCD alerts you when the feed dog or sewing foot are in wrong positions, the thread runs out or breaks, batteries are low, or necessary attachments aren't present. On-screen help tells you which presser foot, thread tension, and feed type should be used for any given stitch selection. Additionally, the $799 Creative Fantasy embroidery unit attaches through the rear port and can execute up to 16-color, 8,000 satin-stitch wonders at the push of a single button. If for some reason you get bored with the 229 utility and decorative stitches in the machine's memory, you can purchase additional ones on PC cards, edit the ones onboard through the interface, or create your own using the $379 PC-Designer software. It may cost $3,599, but it's worth every stitch. **Pfaff; www.pfaff.com; 201.262.7211**

Original or purchased designs can be saved to memory cards for later or repeated use.

Download original designs from your computer **through this standard serial port.**



JVC HC-E100 Portable E-Mail Device

When you're trapped in a world of digital PBX lines, cell phones, and pay phones, JVC's Portable E-Mail Device comes to the rescue. Essentially, the $130 device is a small PDA, complete with mini-QWERTY keyboard and 240x64-character monochrome LCD that receives, reads, composes, and sends e-mail. But instead of requiring a "safe" RJ-11 phone jack, JVC's 10-ounce wonder goes old-school, back to the day when modems used to tap phone handsets with a cradle for the speaker and mike. By adjusting the speaker built into the unit and lining up the microphone to whatever phone you have access to, you've got mail (via PocketMail's 1-800 access, which currently runs $10/month.) **JVC; www.jvc-america.com; 800.252.5722**

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Wacom Intuos and CalComp Creation Station Pro Graphics Tablets

If you haven't used one of these next-generation graphics tablets lately, you haven't used a graphics tablet. The quirks that plagued earlier tablets have been addressed, and features that were unimagined until recently are in effect.

Both the $750 Wacom Intuos and the $600 Creation Station Pro by CalComp come in dimensions up to a spacious 12x18-inches, but Wacom ups the ante with 1,024 levels of pressure sensitivity compared to the still impressive 512 levels of the Creation Station Pro. In addition to pressure-sensitive pens with built-in eraser features, both tablets also come with five-button mice. Wacom takes the rodent one step further, adding z-axis response for 3D control and Dual Track support, allowing simultaneous mouse and pen input. This proves unbelievably handy.

For a few dollars more, you can add a special soft-tip Stroke or Inking pen to the Intuos. Especially effective is the optional airbrush tool that nearly perfectly replicates the look-and-feel of its real-world counterpart.

Either way you go, digital artists will take their strokes to a whole new level with one of these next-gen tablets.

Wacom; www.wacom.com; 800.922.9348 | CalComp; www.calcomp.com; 800.458.5888

Both these next-gen tablets come with killer mice, in addition to strokable pens.

In-Harmony Technologies Venus3D

Generating 3D models has been a major hassle. Laboriously hand-building models based on polygon primitives, meticulously tracing 3D still models with elaborate armatures, painstakingly scanning 3D data line-by-line: none of these elaborate methods work for one of the most commonly needed models—the human face. Venus3D is the solution. For less than $10,000, two digital cameras capture both the image that serves as the extrusion map for a 3D model (aided by an RGB grid flashed on the subject) and the full-color texture map that provides skin. In 1/200th of a second (plus a brief down-load to any PC), you have an astonishingly accurate 3D model of your subject that can be rotated or positioned however you please. **In-Harmony Technologies; www.inharmonytech.com; 707.769.5056**

The many faces of Big Daddy are based on a single snapshot taken with the Venus3D.

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FAST FORWARD

TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at **thalfhill@maximumpc.com**

It's Time to Swing

NEW JAVA TOOLS MAKE MUCH BETTER APPS

Sometimes you have to stop listening to all the hype and counterhype, roll up your sleeves, buy a liter of Jolt cola, and write some code. In other words, you've got to find out for yourself what's really going on.

That's what I recently did with the Java Foundation Classes. The JFC is an API—a prewritten code library that programmers can use to build software more rapidly. It's a standard extension to Java 1.1 that tries to fix many of the problems that have afflicted Java developers for the past three years. Those problems have included a sparse cupboard of GUI components, inconsistent behavior across different native platforms, poor support for printing, and sluggish runtime performance.

Critics repeatedly cite those flaws as proof that Java is all hype and no beef. The flaws are real. But all they prove is that Java is struggling through the same immaturity problems that all new platforms suffer.

If you're an old-timer, you might remember how Microsoft announced Windows in 1983, shipped it in 1985, and toiled for years before finally winning respect for Windows as a serious platform in the early 1990s. Before the third major release, Windows was a joke, even among PC users. Windows 3.1 opened the floodgates and overwhelmed DOS, OS/2, the Mac, the Amiga, and almost everything else that stood in its path.

Java 1.1 is only the second major release of the Java platform. The third release (known as 1.2) should be available by the time you read this. Fortunately for Java developers, Sun didn't wait until Java 1.2 to ship an early version of the JFC. Important pieces have been available for several months, and the complete library is a core package in Java 1.2, not just a standard extension.

Until my recent experiments, I'd been writing applets for Java 1.0.2, the first version of Java. Java 1.0.2 has lots of problems, but it's the version most widely supported by web browsers. To test the JFC, I wrote my first real Java application using Java 1.1 and Symantec Visual Cafe 2.5. (The terms "applet" and "application" have special meanings with Java. An applet is a program that runs inside a web browser under tight security restrictions; an application is a regular program that has no restrictions.)

My discovery: The JFC is a huge improvement. It's like night and day.

For starters, the JFC has a much richer collection of GUI components. The GUI library in Java 1.0.2—known as the Abstract Window Toolkit (AWT)—has your basic buttons, menus, scrollbars, and so forth, but they're not as versatile as they should be, and quite a few things are missing. Although third-party tool vendors have filled the gap with add-on libraries, Java desperately needed a better assortment of standard components.

The JFC's GUI library is nicknamed "Swing." I used Swing components exclusively in my application, and I was blown away by their superiority over AWT controls. For the first time, I feel like I can write a Java program that's fully the match of any program built on native APIs—without resorting to third-party libraries.

For the first time, I feel like I can write a Java program that's fully the match of any program built on native APIs.

Swing has many other advantages, too. It has greatly enhanced support for printing and fonts. It has a "pluggable" look and feel, so developers can easily alter a program's appearance. The final version of the JFC will have four GUI styles: Windows, Macintosh, Motif (Unix), and Metal (a cross-platform GUI unique to Java). Programmers can use any style on any native platform (such as Windows on Mac, or vice versa). Another option is a program that senses which native platform it's running on and automatically adjusts itself to match. Yet another option is a program that lets the user choose a style via a control panel.

In contrast, AWT controls always assume the appearance of native controls. When a programmer uses an AWT component, Java calls a matching component in the native API. It sounds logical, except it limits the AWT to the common denominator of components across all native platforms, and it sometimes results in strange behavior when the native components don't behave as expected.

Swing components are written completely in Java. The only native API calls are to low-level graphics routines common to all platforms. That's why Swing components are more versatile, more numerous, and more consistent. They're also faster, in part because just-in-time (JIT) compilers can do a better job of optimizing them. Another factor is a more efficient mechanism for detecting key presses, mouse clicks, and other events.

Suddenly it's a lot easier to write Java software that's as good as native software. But don't expect to see many JFC-based applets anytime soon—it'll take a while for the web browsers to catch up with this technology. In the meantime, developers can use the JFC to write powerful, attractive applications that don't need a browser. This Swing set definitely ain't a toy.

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ON THE LINE

SHEL KIMEN
has worked in the industry, traveled the world, and covered the Internet for both The Net and boot magazine. She can be contacted at **skimen@maximumpc.com**.

For Media Richer or Poorer

WHAT TO SEE ON THE WEB, WHERE TO FIND IT, AND HOW TO VIEW IT

One too many people have asked me whether there's any good "media-rich content" to be had online. So, what the hell is "media rich"?

Despite the absurdity of the jargon, as if some media could possibly be more media than other media, I understand the source of the question. "Is there anything cool that eats processing power, requires significant bandwidth, *and* is mildly interesting?"

I guess it depends on what's "interesting." If TV is interesting, then yes, there's lots of media-rich content. The networks are ready, willing, and able to pipe content to your desktop. In fact, any broadcast company that isn't barreling down the "interactive TV" path by the end of '99 may as well file chapter 11 now. Bold statement? NBC already has models of its studios with streaming audio and video of its shows. Want to hear Madonna in a 3D representation of the Saturday Night Live set? No problem. (**www.nbc.com/nbc/webspecials.nbc**)

So I installed the RealPlayer G2, the latest and greatest realtime audio/video player from Progressive Networks (**www.real.com**). Then I installed Microsoft's Media Player (**www.microsoft.com/windows/mediaplayer**), which is pretty much the same as the G2.

A little more significant is Windows 98. "With a TV tuner card, your PC can act as a receiver of broadcast information. You can use your PC to find and watch TV programs, view interactive TV programs that provide supplemental information about shows, and receive other information," according to the Microsoft web site. Hmmm.

Since Netscape is incorporating Flash into its native code for version 5.0, one could also say that *Navigator/Communicator* is also a media player. And another company to pay attention to is Xing (**www.xingtech.com**). Xing supports MP3/MPEG (audio/video) and DVD, and the streaming of both. Other audio players? FreeAmp (**www.freeamp.org**), Sonique (**www.sonique.com**), and SoundPlay for the BeOS (**www.be.com/beware/Audio/SoundPlay.html**) should get you started.

Three cheers for OZ COM (**www.oz.com**), the San Francisco–based Icelandic wonder kids! In January, the company released Fluid3D, a beta plug-in for the G2, which streams files made with *SoftImage*, *3D Studio Max*, and VRML 2.0 through the RealPlayer. At last, a viable path for professional animators to get those bandwidth-heavy, but oh-so-beautiful, animations on the web. The plug-in is only 350K.

And if you want to forgo plug-ins altogether, brace yourself for the latest technology from *Maximum PC*'s own columnist, Alex St. John. The architect of DirectX has founded a company (**www.wildtangent.com**) that allows the Java component of any Java-enabled browser to perform all the 3D-accelerated media madness promised by Chromeffects (which may or may not be dead, depending on who you talk to), *without* the overhead of Microsoft's bloatware. We downloaded a 150K *3D Studio Max* file of a jumbo jet, and in less than 10 seconds (on our T1 line), we had a fully rendered and shaded plane to spin, zoom, and position at will. Amazing.

But where, you might ask, do I get all this (worthy) media-rich content to play on my media player of choice?

My personal favorite is Groove Technologies (**www.groovetech.com**). Besides sporting an outstanding radio station (with music that strikes my particular fancy) and streaming video of its DJs (corny but cool), the site also previews albums, runs live events, and weekly specials.

For other techno dance tunes there's also Raveworld (**www.raveworld.net**), which, in addition to streaming audio and video, has a "Mixlab" where users can create their own CDs.

proteinTV (**www.proteintv.com**) is a top-of-the-line forum for independent musicians and filmmakers. A delicious interface offsets the as-of-yet slim, but qualifiably good offerings.

Then there's **Broadcast.com**. It's a little unfocused, and pushes out everything from music and audio books, to shopping channels, and yes, even God. No lie. Check out streaming 700 Club or Christian rock.

And just so you know, Christians aren't the only faithful jamming the (Inet) airwaves. Pop over to Shalom Net for live services (**shalom-am.com/liveaudio.html**).

The problem I'm having with most of this media-rich content I find is that it's one way. Obviously the TV model is the dominant paradigm, and I'm not sure watching videos on my desktop at work is any more satisfying than watching videos on my VCR at home. (I'm also not sure I want to work and play on the same machine either, given the choice.) What I am interested in seeing, however, is how the convergence evolves. What does "broadcast" become when combined with the web? Will I trade in my mouse for a remote control?

Any broadcast company that isn't barreling down the "interactive TV" path by the end of '99 may as well file chapter 11 now.

EVERYONE
E
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Tokyo

SEGA PC

You built yourself one hell of a tower. Luxury condos, sushi restaurants and a subway station ten stories down. You thought of everything. Except the service elevator. Now the maids can't get to the hotel rooms and you're charging execs two grand a night to bunk with cockroaches. Probably not the best way to get a five star rating, huh? From Yoot Saito, the creator of Sim Tower.
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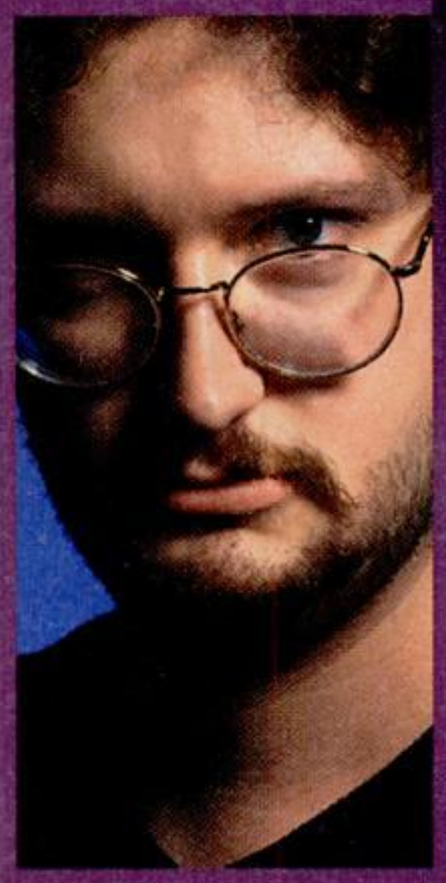
GAME THEORY



T. LIAM MCDONALD
is a veteran of PC Gamer magazine and is much bigger than he looks in this picture, so keep that in mind before writing him any hate mail at **tmcdonald@maximumpc.com**.

Turning a Deaf Ear to the Disabled

TOMMY WOULD NEVER HAVE BEEN A PINBALL WIZARD ON THE PC

Next time you're playing the latest game—say *Half-Life* or *SiN*—try an experiment: play it with the sound off. You're free to turn on any subtitling option, if the game indeed has any.

Chances are high that you died quickly because you didn't hear that monster approach, or maybe you missed an important clue muttered by a passing character, or maybe you didn't hear your engines cut out.

That's the kind of frustration reader Jerald M. Jordan wrote to express after my column on *Half-Life*.

"I gather *Half-Life* requires hearing in order to properly play it. This illustrates the dilemma I face every time I buy a computer game. I am (and have been for more than 60 years) totally deaf. I enjoy computer games, and they never presented a problem in the past, but they do now. More and more give auditory cues where they used to be visual (text). Worse still, there is no way of knowing this without actually playing the game. The box doesn't show anything like that. And, once you break the shrink wrap, you can't take it back, so I'm out $40 or so unless I can find a friend who will buy it from me."

It wasn't long ago that PCs didn't even have soundcards, so sound wasn't an integral part of the gaming experience. The first sound squeaks and beeps were so bad they were almost always turned off. The rise of soundcards brought music, effects, ambiance, and even dialogue in games. Now they are often an essential part of the gaming experience. Important clues are revealed through sound, ranging from ambient effects that signal danger, to important story elements done solely through dialogue. Captions are often supported for dialogue, but not on every title, and never as an aid to the deaf by captioning crucial sound effects.

Things are easier for the deaf than for the blind. Quick: Name all the games published last year that could be played by a blind person. Don't bother: there are none. There are a number of areas of gaming that must forever be closed to the blind, such as almost any simulation where hand-eye coordination is key, most strategy games where map analysis is a central component, and role-playing games where environments are too complex to ever be meaningfully enjoyed by those without sight. With a little creativity, however, adventure games could be made that the blind could enjoy. Infocom text games, for example, could easily be used with a simple text-to-speech converter.

There are even possibilities for more complex, visually oriented games. Let's take *Blackstone Chronicles*: a straightforward narrative puzzle game where you use a mouse to search a screen for items, speak to ghosts, and navigate a haunted insane asylum. Each screen could be audibly described. Hot spots could produce sounds. The game already audibly describes each object you click, simply extending this audio support would make the game accessible to the blind.

One need only look to DVD technology to see how to do it. One of the monumental action movie classics, *Terminator II: Judgement Day* has dazzling special effects and breathless action sequences that would seem to be inaccessible to the blind. But DVD is capable of some marvelous things, one of them being multiple audio tracks, which are usually used to offer a movie in various languages, as well as separate running film commentaries by people key to the production. The DVD of *T2* offers a special feature developed by WGBH Education called Descriptive Video Service, which is used on some special home videos and TV broadcasts (see **www.WGBH.org** for more info). The DVS track enables the blind to enjoy the movie. In between lines of dialogue, a narrator offers colorful descriptions of the action on the screen.

Of course it's not the same as seeing it. It's much more like a radio play, where you must use imagination to create a movie in your head, or like an audio book. But it opens up this magnificent movie to the blind where it would otherwise simply be a series of disconnected dialogue and loud sound effects. With some creativity, such technology could easily be used to create adventure games that could be played by the blind. Similarly, more elaborate subtitling could make action games more playable by the deaf. Maybe an on-screen graphic could give a directional cue to match an audible cue in the game, visually representing the sound of a *Quake* trooper entering a room.

With 40 million deaf or blind people, there's no need to even appeal to the altruism of the game makers. Games enhanced for the deaf or blind would find a substantial market, and open up this medium to people who couldn't otherwise enjoy it. ✹

Quick: name all the games published last year that could be played by a blind person. Don't bother: there are none.

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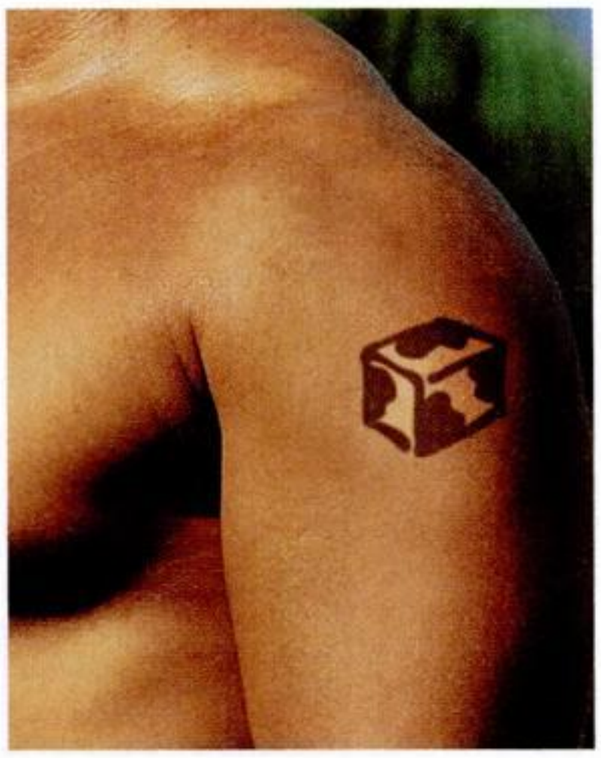

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SPEED

Tom Furlong, the senior vice president of graphics-workstation powerhouse Silicon Graphics explains why his company is looking beyond proprietary Unix boxes and explains how these new NT workstations promise to be the "fastest in the world."

Maximum PC id Software's John Carmack said, "I suspect [SGI] has underestimated the level of competition in the PC space. I bet they aren't going to be better than Intergraph, but they're certainly welcome to surprise me."

Furlong What we are going to surprise people with is that we're going to have that level of performance at $3,395. Texture memory has traditionally been a very limited, very expensive resource. And there are only so many slots on the board to plug in more. We have enough memory to work in realtime across an uncompressed multistream, minute-long commercial in memory. Production houses will use $300,000 DECs that do nothing but store a minute worth of content as they run back and forth over it a hundred times. We can do that on our $3,395 workstations!

Maximum PC How is that possible?

Furlong Our boxes were designed from the ground up to be workstations. So although our products are based on Intel microprocessors and Windows NT/2000, we've developed a chipset with a level of performance right up there with the highest-performing machines you can purchase today. But we're providing that level of performance below $3,500. Put simply, our boxes are blowing the doors off the price/performance paradigms.

Maximum PC What makes your graphics pipeline so powerful?

Furlong For almost 20 years now, Silicon Graphics has been working on improving geometry engines and graphics pipelines, trying to determine what areas should be done in hardware and what done in software. About two years ago, we were able to achieve a relatively major milestone in that we were able to put an entire OpenGL pipeline down into a single chip within the memory controller chip. What used to take tens of boards in our earlier systems and thousands of chips in our Onyx-based systems and Reality-engine-based systems was now to a point where you could place the entire pipeline within the corner of a single chip. The net result is that we're now able to put about 10 million transistors of our graphics and media capabilities—including the multiple parallel streams, multiple lighting engines, geometry engines, different rendering engines, and texture engines—inside the core chipset. This single piece of silicon is able to accelerate the standard 3D graphics API within the Windows NT operating system.

Maximum PC Are you suggesting that Intel's architectures aren't fast enough for high-performance graphics?

Furlong Right. Fundamentally, graphics are a parallelizable problem. But once you've got it to fit inside a chip, you can start to break it down into its constituent parts. The PCI bus wasn't fast enough for doing high-performance 3D graphics, and AGP 2x only runs at 512MB/sec. Our graphics architecture has about 3.2GB/sec of bandwidth dedicated to memory—that's six times the bandwidth of the current AGP spec. Plus, you're able to use

PROFILE

And he would be...?

Tom Furlong is the senior vice president of SGI's Visual PC Group. He's responsible for aggressively pursuing the company's opportunities in the Intel Architecture/Windows NT market.

And I would know him from...?

SGI is well known for its high-priced, proprietary hardware systems, which are used by major motion picture production houses and graphic designers. But this month, SGI is introducing something new: PCs using Intel processors and Microsoft's Windows NT.

And I would care because...?

There's a twist! These new NT boxes also incorporate SGI's proprietary—but killer—graphics technology, and a memory bandwidth that's six times faster than Intel's AGP bus! And if Furlong has his way, all this technology will work its way into the consumer PC desktop space.

PHOTOGRAPHY BY TIM ARCHIBALD

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FREAK

"3D graphics are our birthright, but we were too wedded to our proprietary systems architectures."

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main memory as texture memory, so you don't have to move textures back and forth across that AGP port for very realistic rendering of texture mapping. Intel's roadmap has AGP 4x by the year 2000, but we're already performing substantially faster.

We've removed the bottlenecks inherent in the PC architecture. We've developed an architecture that allows the CPU-to-memory transactions to take place at the same time you're doing graphics rendering, geometry, lighting, texturing, or multiple PCI buses getting into memory. And we've built a crossbar inside our advanced visual computing architecture chipset that lets us parse out the total available bandwidth among all consumers without any of them having to funnel through an individual component area.

Maximum PC As good as your architecture promises to be, is it good enough to persuade consumers to ditch Intel?

Furlong The Silicon Graphics core chipset costs more than the Intel core chipset, and unless we achieve phenomenal volume, there's going to be a price premium. However, that premium positions us very well in the workstation marketplace. In terms of trying to bring our graphics technology down to the home user, we'll probably choose to leverage Intel motherboards and offer graphics cards that can be plugged in.

Maximum PC Let's talk about the new boxes first. What's in them?

Furlong The first box—the 540—is a machine that everybody expects Silicon Graphics to build: a $6,000+ full tower with four of the fastest Xeon processors and a dedicated graphics pipeline. But one of our competitors would, more than likely, cut some corners in order to make the product more affordable and match us on some obscure benchmark, then they'd proclaim "SGI performance at half the price!" So we built a second machine that made a few trade-offs—the $3,395 320 minitower. This is a Pentium II–based product with one to two processors that utilizes higher volume but more standard peripherals. The 320 and the 540 have the exact same core silicon, and both have a 100MHz frontside bus. But the $5,995 540 has substantially more expandability in terms of processors, in terms of I/O capabilities, in terms of PCI buses, in terms of SCSI capabilities. The 320 is the best mix of price and performance.

Maximum PC Who came up the striking new industrial design?

Furlong Our typical customers usually have the word "designer" in their title. To that class of person, the aesthetics of the machine matters a lot. The color scheme appeals to a designer and we've tried to work in the rich look of the darker colors, with the hint of purple as an accent color, to really bring out the whimsy present in serious work being done by designers.

Maximum PC That sounds like the same emphasis on aesthetics that Apple placed on the iMac.

Furlong Like Apple, we designed everything we think is really important to doing graphics and media tasks into the core chipset. You don't need to plug anything else in, you don't need to load any device drivers, you don't need to go out and buy special peripherals. It just works.

People who have traditionally done their work on the Macintosh will want to seriously consider this product. The applications they've traditionally used on Macs have long since moved to NT, but no PC vendor has come along and said, "I'm going to take care of this very difficult task of making sure everything works for you." That's what we're doing.

Maximum PC Will these NT boxes have a floppy drive?

Furlong Yes, they will. On our Unix line, we've traditionally left it out, since floppy disks can't accommodate the sorts of files we work on. But we're always asked, "Where's my floppy? I have personal information that I want to be able to put in and take out. I want to put it in my pocket and get on a plane and go somewhere else and put it in that machine."

A floppy drive isn't expensive to build into a system and it doesn't make sense not to give customers what they want.

Maximum PC Is Windows NT perfect?

Furlong NT is a very good operating system, but there are always things you'd like to see addressed, such as scalability issues, image sizes, realtime aspects, things like that. Thankfully, Microsoft's roadmap is addressing this. With Windows 2000, it's actually going to be bringing a lot more ease of use from the Windows code base into the NT product line. And that will be a very good thing. Bringing those application bases together will be very powerful for enterprise computing and home computing.

Maximum PC What about Linux? Do you see it unseating Unix?

Furlong I don't see that happening. While different companies have been able to take a standard Unix product and tweak it to bring their value-add to the market, the result is that many ISVs have decided that the Unix market is too fragmented. Therefore, we need to move into a single supportable application base. NT fills that need. A level of standardization has happened with NT because Microsoft made decisions that you really couldn't get a dozen companies, each doing their own version of Unix, to agree to.

One reason Linux has taken off is because what everybody wants out of Unix is performance, scalability, and tools that run the exact same way on many different boxes and architectures.

Maximum PC You've aligned yourself with Intel's processors. What about AMD's K7?

Furlong We have a very close relationship

"Our goal is a level of performance that cannot be purchased on a PC platform, regardless of howmuch money you have."

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with Intel, where we share a lot of excruciatingly detailed trade-secret information. To do that right out of the chute with multiple vendors is just a level of complexity we couldn't consider doing.

Intel has a leadership roadmap. Intel tends to bring out the power microprocessor first and does a great job of moving it down in price until it gets to consumers. That's what we have always needed. We get a bigger bump out of following the power curve than we do out of following the cost-reduction curve.

Maximum PC But AMD touts the K7 as being a lot more powerful than Intel's current roadmap.

Furlong Trying to get the level of interface we needed to keep up with the Intel roadmap has been a full-time job for the whole engineering team. To consider doing that with another microprocessor vendor is very difficult.

Maximum PC So what kind of benchmarks can we expect?

Furlong We're in the middle of doing them, but it's stunning.

Maximum PC Stunning? That's a pretty strong claim.

Furlong Our competitors have built really sophisticated scalable computers just to make up for the interface limitations of where they put graphics in their systems. We took graphics and put it right next to main memory and said, "Use main memory for everything." Thus, you don't have to pay for expensive memory dedicated to graphics or texturing or something like that. Memory is memory. The simplicity of our design is based upon the Unified Memory Architecture that only moves data once into the system, and from then on it's passed by reference. The frame you're looking to use as a texture can be found at this address. The image from disk can be found at this address. The network connection can be found at this address. Only once does the data move through the system, and it moves at ten times the I/O bandwidth of a standard Intel motherboard and six times the memory bandwidth of the standard Intel motherboard. And it only moves once. In other systems, textures are brought in from the disk, sent into the disk buffer, transferred into main memory, transferred into texture memory, then transferred into graphics memory. You have these huge images bringing the I/O subsystem of these machines to their knees and being passed around willy-nilly by all these processors that just don't care that the core architecture is not good at moving big data around.

Our core architecture is really good at moving big data around. And we don't move it around.

Maximum PC Shouldn't your competition be running scared?

Furlong I think that will be called for. Our goal is to deliver a level of performance that cannot be purchased on a PC platform, regardless of how much money you have.

Maximum PC How important is the jump to NT for SGI as a company?

Furlong It's paramount to the turnaround of the company. Silicon Graphics has enjoyed a very high-end, high-margin business, and as PCs and operating systems have become more and more powerful, the volume from that market has been eroding into the NT workstation space. And it's critical for SGI to be number one or number two in workstations, be they Unix- or NT-based. But it's not something where we all go home if it doesn't work.

Maximum PC But critics claim the move to the NT market is a last-ditch effort for the company to regain profitability. True?

Furlong Our decision to get into the NT market is driven by our customer's needs. For a long time, the applications our customers ran were Unix-only. But application vendors have been moving from Unix to NT. Our graphics customers recognized that with NT, they could get the specialized solutions they work with on a daily basis and the ease-of-use of everyday personal-productivity apps on a single platform.

Maximum PC If you had a Delorean and could go back in time, what would SGI do differently?

Furlong 3D graphics are our birthright, but we were too wedded to our proprietary systems architectures. I would have investigated bringing our graphics capabilities out onto the standard platforms earlier. Had we done that, the proliferation of multiple 3D graphics companies wouldn't have happened. We would've taken the leadership mantle and served anybody who was interested in 3D graphics, regardless of platform.

Maximum PC If SGI is so strong in the 3D graphics arena, why hasn't SGI been a player in the consumer 3D space?

Furlong We just couldn't do the applications that our customers demanded on the Intel/Microsoft platform, but with the Pentium II/Pentium II Xeon and NT 4.0/Windows 2000 operating systems coming out, you can run very demanding high-performance applications on this platform.

Maximum PC SGI has been accused of an elitist attitude. How has the move to NT affected this?

Furlong Silicon Graphics has always been about quality and performance, and not compromising either. And when we set out to bring that quality and performance to the standard platforms of Intel and Microsoft, we did it with the same aplomb. We're going to do the job right; we're going to leverage 20+ years of designing graphics systems with quality and performance. Our products will ultimately speak for themselves.

"The applications designers have traditionally used on Macintoshes have long since moved to NT, but no PC vendor has made sure everything works. That's what we're doing."

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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CHERI

"You don't have to live with a wimpy system."

PHOTOGRAPHY BY JACK HUTCHESON

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STEN YOUR SYSTEM

Nothing breaks our hearts like discovering a brand new 450MHz machine has been crippled by the system manufacturer. Either voluntarily or by evil edict, the men on the assembly line fill hard drives with resource-hogging applications you'll never use, turn off switches that would give you major speed increases, and leave out software support for the technology you paid for. Hell, that's just the short list. The basic Windows configuration is just plain annoying.

But you don't have to stand for this. Whether you've just removed a brand new system from its packaging or have been using the same old P166 for years, follow the next 30 tips to maximize your machine's potential, prepare it for future expansion, and make it easier to use. Our pointers represent the best of *Maximum PC's* institutional knowledge—and we're the type of guys who like to roll up our shirt sleeves and tweak systems down to the motherboard, BIOS, and Registry level. We close out the article with some killer tips from readers, a bottomless resource of knowledge and ingenuity. Ahoy.

30 Tips to Blast Performance Out of the Box

1 A clean place to swap

Windows works best when its swap file lives on a fast, uncluttered hard drive. If you want the best performance out of your dual-drive PC, you should determine which drive is the speediest and then free up enough space on that drive to fit your swap file. You can determine how much space your swap file currently takes up by looking at the size of the WIN386.SWP file in the Windows directory. To relocate the swap file, open up the Virtual Memory settings in the Performance section of your System Properties and specify the new hard drive. If you have one hard drive, get a good hard drive partitioning utility, such as *PartitionMagic 4.0*, and put your swap file in an empty partition. If you can dedicate a partition solely to your swap file, you don't have to worry about it becoming fragmented through reading, writing, and erasing other files.

2 Knowing is half the battle

If you're running Windows 98, check out the new tools available in the souped-up Microsoft System Information utility. Available from a pull-down menu within System Info, these tools keep your system running smoothly by putting all of Win98's important configuration info under your thumb. The more important tools found here are the System Configuration Utility, which provides intimate access to the innards of your OS, and the System File Checker, which scans and catalogs the version info of all your important DLLs, INFs, and VxDs. If it detects a new file version, System File Checker will prompt you to update the catalog or restore the old version from the install CD.

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3 Schedule regular tune-ups

If you're running Windows 95 with the Plus Pack, OSR2, or Windows 98, you have a cool automation tool called the Task Scheduler (Plus 95's System Agent) that lets you set system-maintenance tasks such as hard drive defrags for times when you aren't using your PC.

4 Store important files in a cool, dry place

Create a directory on an empty hard drive partition for backups of all your important data. Irreplaceable documents, pictures from your new digital camera, browser bookmarks, and saved games are too valuable to lose. Mailboxes are particularly important, and several e-mail apps now include auto-archiving features that automatically backup mailboxes to a safe and secure location.

5 Uninstall what you don't understand

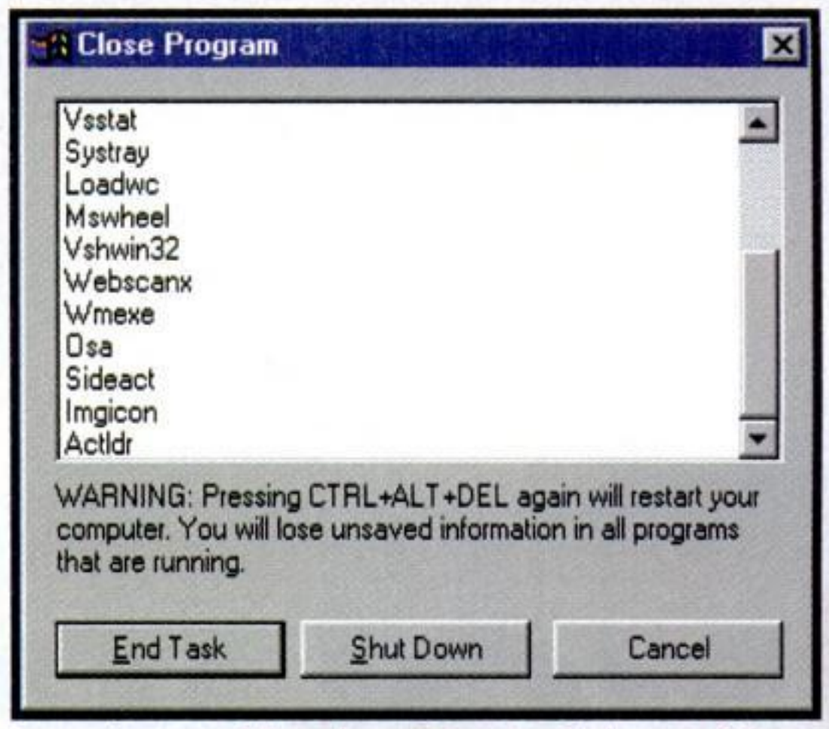
Hard drive space is precious, so you should be familiar with all the software installed on your system. If you don't recognize it, investigate it. Is it useless "edutainment" software installed by the system manufacturer? Does it have nothing to do with the essential operation of your PC? If it doesn't pass muster, use the Add/Remove Programs wizard to yank it from your directories and Registry. Start by uninstalling the contents of your Online Services folder, which consumes about 40MB of disk space care of setup software from various online services. (If you're running Win95, delete these "un-uninstallable" setup programs from your hard drive and their shortcuts from your Start menu).

6 Use ACDSee for image viewing

Just over a meg in size, *ACDSee* is the best image viewer we've ever used. Its thumbnail browser let's you view images without actually opening them, and is customizable ad infinitum. The utility requires very little memory, supports most image formats, and includes advanced features such as read-ahead cache, slideshow, and autosizing. But the best part is *ACDSee*'s speed—much faster than *Photoshop*, *Image Viewer*, and *Paint*. Get ACDSee from **www.acdsystems.com**.

7 Evict System Hobos

HOW IT HELPS You'd be surprised by how many active programs buzz around your system, hiding in the background, eating up precious CPU cycles and memory without permission. Some come pre-installed in your StartUp directory, and automatically load whenever you boot your computer. Others hitch rides on top of applications you install. For example, the Microsoft Fast Find utility automatically installs when you install *Office*. It then loads during startup, and sits in the background in order to index all your documents when your PC isn't "busy." Find Fast slows your PC down considerably every time it updates its file index, so it's a good idea to kill it. In fact, a lot of other subversive background applets should also get the axe.



Recognize any of these bums? You can find most of them hiding in your Startup menu and Registry.

HOW TO DO IT Hit Ctrl/Alt/Del to bring up the Close Program dialogue box, which lists everything currently running on your PC. Do you recognize every program? The applications you voluntarily loaded are easy to spot, but meaningless monikers such as "Osa" and "Vshwin32" make identifying offending programs a little more difficult.

Go to Taskbar Properties and hit the Advanced button under the Start Menu Programs tab. Browse to the PROGRAMS\STARTUP directory. Here you'll find the shortcuts to apps that load unbeknownst to you. Right-click a possible offender, and hit Properties. The Target field under the Shortcut tab will list the name of the program as it appears under the Close Program dialog box (as well as the location of the program for subsequent eradication). Now decide if the program deserves the bum's rush out of either your StartUp menu or hard drive entirely.

If you have system hobos that can't be located in the StartUp Menu, you should find them loitering in your Registry. Fire up REGEDIT, and open the Hkey_Local_Machine\Software\Microsoft\Windows\CurrentVersion\Run (or Run Services) folder to see what Windows is loading behind your back. Now delete the keys that load offending apps. Before editing your Registry, always remember to backup it up via the Export Registry File menu option (choose "all" under Export Range).

8 Remove Memory-Hogging TSRs

HOW IT HELPS AUTOEXEC.BAT and CONFIG.SYS, holdovers from the old DOS days, are batch files that run at startup. Nothing inherently evil about this. Unfortunately, these files launch Terminate and Stay Resident apps (TSRs), which load into system memory until summoned. Chances are these buggers shouldn't be loading until you need them, so wipe 'em out of your startup regimen.

HOW TO DO IT Do a file search for AUTOEXEC.BAT and CONFIG.SYS. Open each with Notepad. Look for items you can nix; for example, "real-mode" DOS drivers and anti-virus scanners. If you're skittish about wiping out a line entirely, simply add REM to the front of the line to disable the instruction. Experiment to get the best results, and then delete your REM instructions if you've disabled an important app. In general, Windows 95/98 doesn't need much in either file to run properly, and you can definitely use all the memory resources possible.

A dirty AUTOEXEC.BAT might look like this:

```
C:\WINDOWS\MOUSE.COM
C:\PROGRA~1\NETWOR~1\MCAFEE~1\SCAN.EXE C:\
C:\WINDOWS\AZTPNP.EXE /A:ON /IDE:OFF
SET BLASTER=A220 I5 D1 T4
```

It should look like this:

```
REM C:\WINDOWS\MOUSE.COM
REM C:\PROGRA~1\NETWOR~1\MCAFEE~1\SCAN.EXE C:\
C:\WINDOWS\AZTPNP.EXE /A:ON /IDE:OFF
SET BLASTER=A220 I5 D1 T4
```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9 Optimize Volume Controls

HOW IT HELPS If a soundcard's mixer controls aren't set correctly, high volume settings will hiss and distort, while low settings will give you anemic acoustics.

HOW TO DO IT Look in the lower-right corner of your Windows Taskbar. If your soundcard is installed properly, you should see a small speaker icon. Double click on it to bring up your Volume Control mixer. As you can see, there's a slider for every channel—MIDI, WaveSynth, CD Audio, etc. Pull all sliders to three-quarter intensity. Now, fire up your favorite audio CD and turn your external speaker volume all the way up. If you hear crackling and distortion, turn down the CD audio slider until the noise disappears. Now, fire up a WAV file. If you hear distortion, lower the Wave volume slider until it disappears. Repeat this process with other sound devices as needed. If you find you need to turn a bunch of sliders down, your master volume control may be too high. Pull back on the master control until your sound is clear. Finally, make sure each slider's Mute box is unchecked.

Don't mess with my sliders... I got 'em tuned just right.

10 Overclock Your CPU

HOW IT HELPS By flipping a few motherboard jumpers or adjusting a simple BIOS setting, you can actually increase the clock speed of your CPU, effectively turning a 400MHz Pentium II into a 450MHz, for example. The process is called overclocking. It generates a lot of extra heat and can result in fried CPUs, so don't even think about trying it unless you have a strong stomach. Overclocking is also reviled by much of the computing industry and voids warranties. Still, thousands upon thousands of people have taken the overclocking leap of faith with no ill effects, so the practice must have some merit, right?

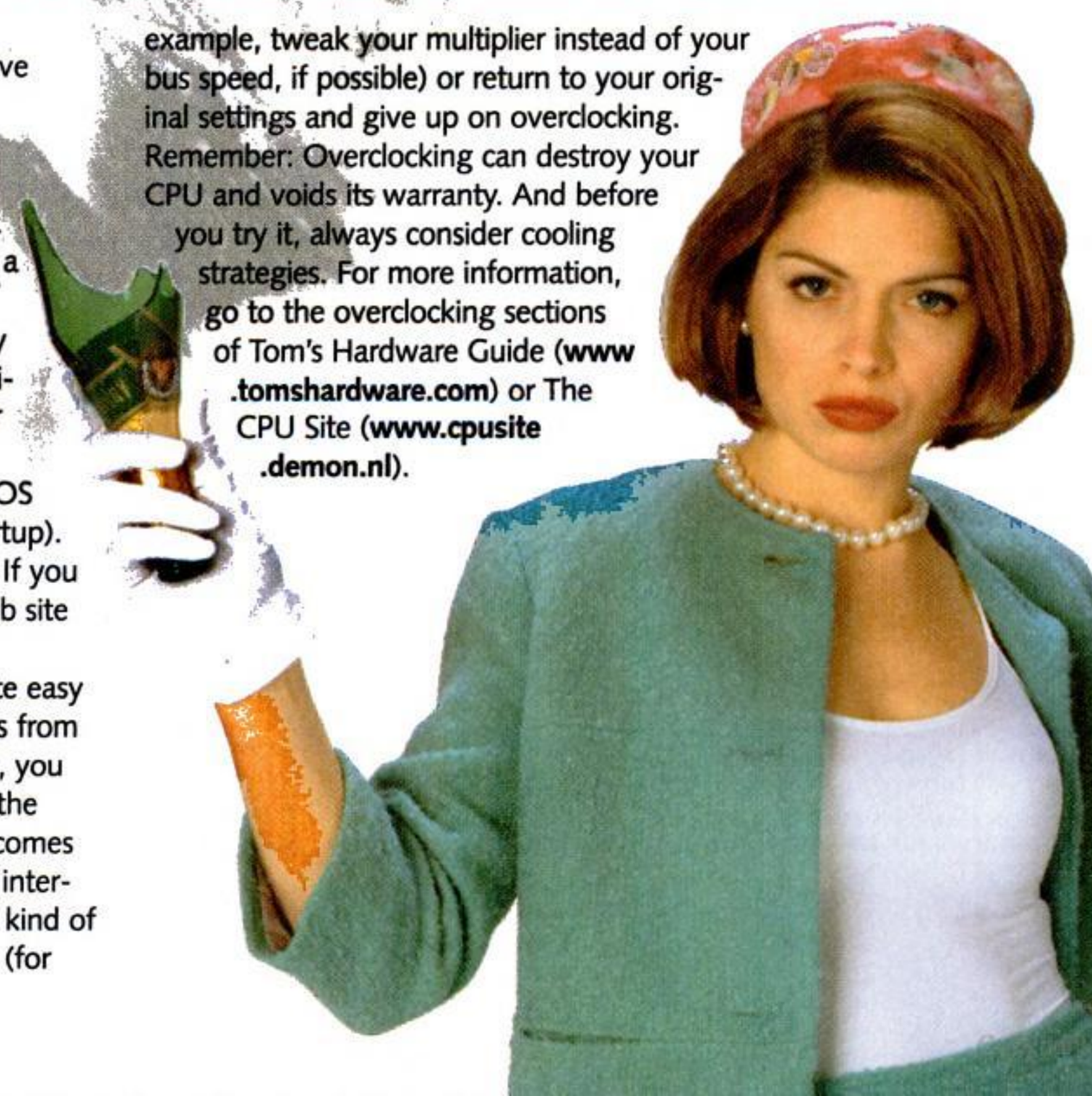
Celeron 266 with 4.0 Multiplier	
Bus Speed Tweak	Resulting Speed
66MHz	264MHz
75MHz	300MHz
83MHz	332MHz
100MHz	400MHz
103MHz	412MHz
112MHz	448MHz
124MHz	496MHz

Celeron 300 with 4.5 Multiplier	
Bus Speed Tweak	Resulting Speed
66MHz	297MHz
75MHz	337MHz
83MHz	373MHz
100MHz	450MHz
103MHz	463MHz
112MHz	504MHz
124MHz	558MHz

The Celeron overclocking schedule illustrates just how high you can go with the bus adjustments on today's motherboards. Just expect major cooling and instability problems with the fastest bus settings. At these speeds, CPUs, core-logic chipsets, RAM, and PCI cards have difficulty cooperating with each other.

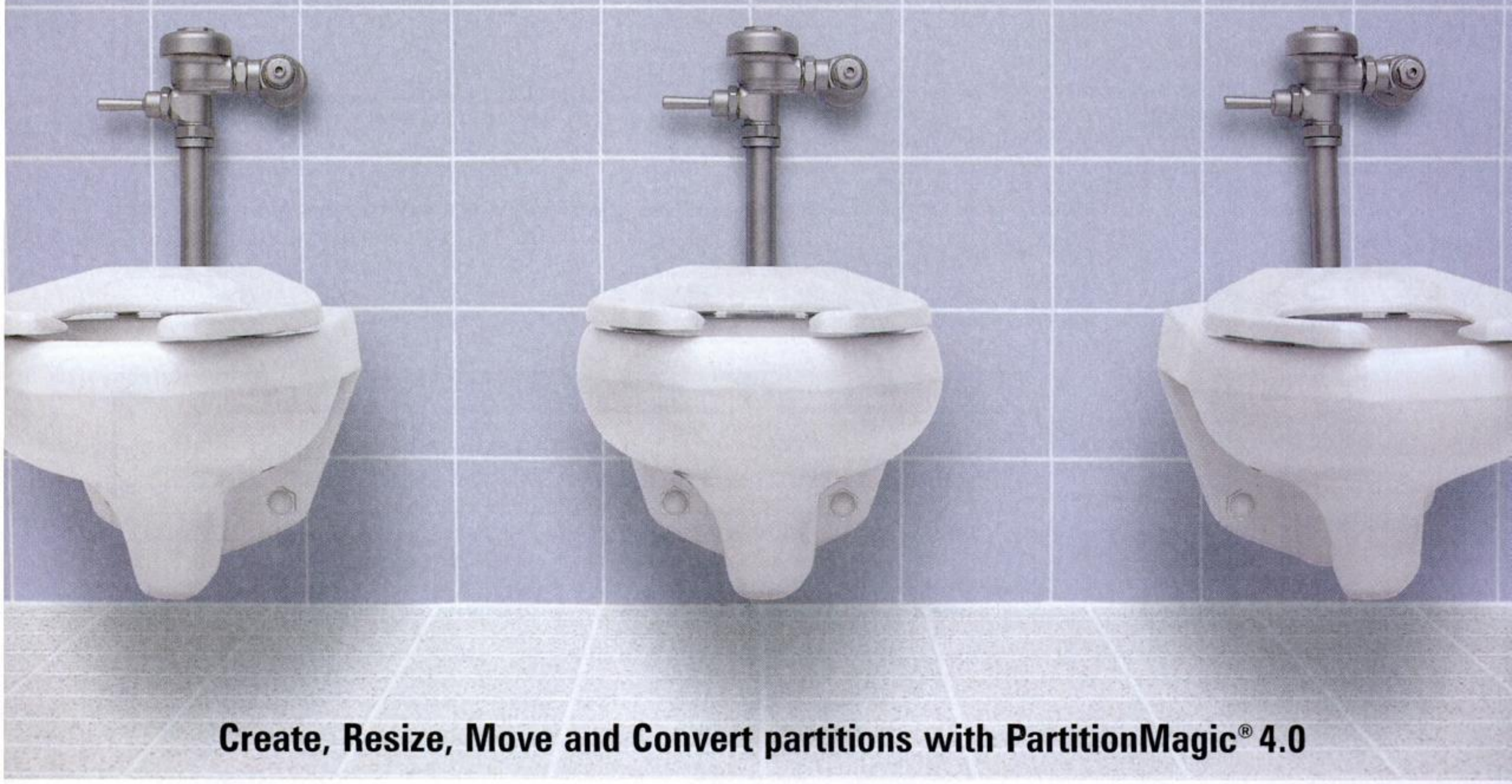
HOW TO DO IT A CPU's speed is determined by the speed of the system bus multiplied by an arbitrary number (aptly called a multiplier). For example, a 400MHz Pentium II is the product of a 100MHz system bus and a 4.0 multiplier. To get to 450MHz, you'll need either to increase the system bus to 112MHz, or stay at 100MHz and raise the multiplier to 4.5. System bus and multiplier settings have traditionally been set through physical jumper switches scattered across your motherboard. In more modern systems, however, the settings are integrated into the system BIOS (which you can enter by hitting either DEL, F1, or F2 during startup). Consult your motherboard manual for the bus settings location. If you don't have a manual, go to the motherboard manufacturer's web site and look for online documentation.

Currently, Intel Celerons are the overclocker's darling. It's quite easy to raise a 300MHz Celeron to 450MHz by upping its system bus from 66MHz to 100MHz. Of course, during any kind of overclocking, you always want to increase speed by a single increment (known in the industry as a bin) and test for system stability. Severe instability comes in the form of boot failure. Mild instability comes in the form of intermittent system lock-ups and graphical glitches. If you suffer any kind of instability, you may want to try a different overclocking strategy (for example, tweak your multiplier instead of your bus speed, if possible) or return to your original settings and give up on overclocking. Remember: Overclocking can destroy your CPU and voids its warranty. And before you try it, always consider cooling strategies. For more information, go to the overclocking sections of Tom's Hardware Guide (**www.tomshardware.com**) or The CPU Site (**www.cpusite.demon.nl**).



Does the thought of no partitions terrify you?

(No wonder your computer keeps freezing up.)



Create, Resize, Move and Convert partitions with PartitionMagic® 4.0

PartitionMagic 4.0 works with Windows 98 and includes a free copy of BootMagic. Buy it now and get $15 back from PowerQuest.

Visit your local software reseller or call 1-800-379-2566 or +1-801-437-8900 for details.

You couldn't operate without partitions. What makes you think your computer can? Partitioning your hard drive plays an essential role in maintaining your computer—preventing conflicts, protecting data, and dramatically improving efficiency. Best of all, partitioning lets you reclaim up to 40% of your wasted hard-drive space! And now, with even greater functionality and ease of use, PartitionMagic 4.0 puts all the benefits of hard-drive partitioning within easy reach of anyone. Create and resize partitions on the fly without losing data. Effortlessly move applications between partitions, converting from FAT to FAT32 and back again. Or use BootMagic,™ included with your purchase of PartitionMagic, to manage and switch between multiple operating systems. Whatever the task, PartitionMagic will help you get it done! So don't get caught with your pants down. *Get PartitionMagic*.

Partitioning better organizes and protects your data and makes running multiple OSs safe and easy!

boot KICK ASS! PRODUCT

WIN 100 WINDOWS MAGAZINE W 1998

BEST OF BYTE Comdex Fall '98

Software Development PRODUCT EXCELLENCE AWARD 1998

Windows Stellar FEBRUARY 1997

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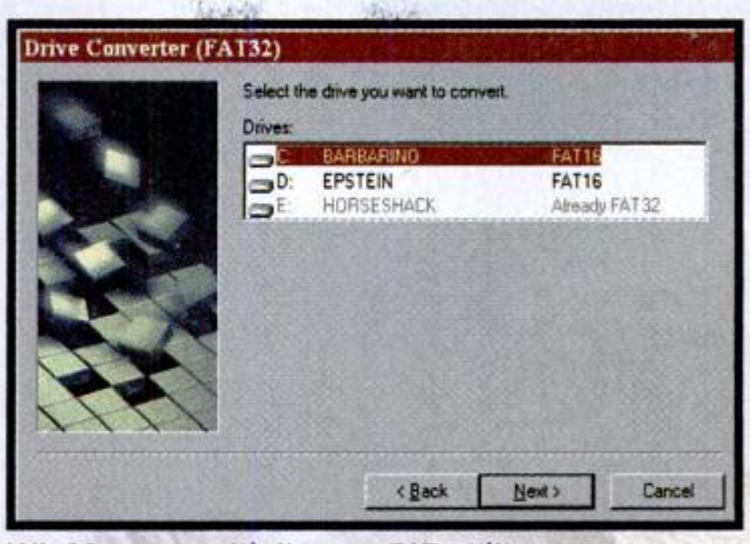
11 Get Fatter

HOW IT HELPS The FAT16 file system is an atavistic throwback to the days when hard drive platters were the size of vinyl records and capacities maxed out at 20MB. OK, maybe FAT16 didn't go back that far, but its sloppy, cluster-wasting ways and 2GB partition limit definitely make you wonder if it was designed in the dark ages. It just doesn't make any sense on the multi-gig monsters of today. Initially introduced in OSR2 and popularized in Windows 98, FAT32 makes more efficient use of larger hard drives by using smaller cluster sizes and supporting partitions of up to 2 terabytes (2048GB). FAT32 actually increases the size of your hard disk through more efficient use of cluster sizes and is a particularly important part of Win98's improved file and memory management capabilities. If you're system is set to FAT16, beef up to FAT32.

HOW TO DO IT If you're running Windows 95 OSR2, look into the *PartitionMagic 4.0* utility to convert from FAT16 to FAT32. (The only method the OS provides is hazardous to hard drive content. The conversion process involves rebooting to a DOS prompt and running FDISK to create a new partition in the place of your old partition.)



Win98 comes with its own FAT utility.

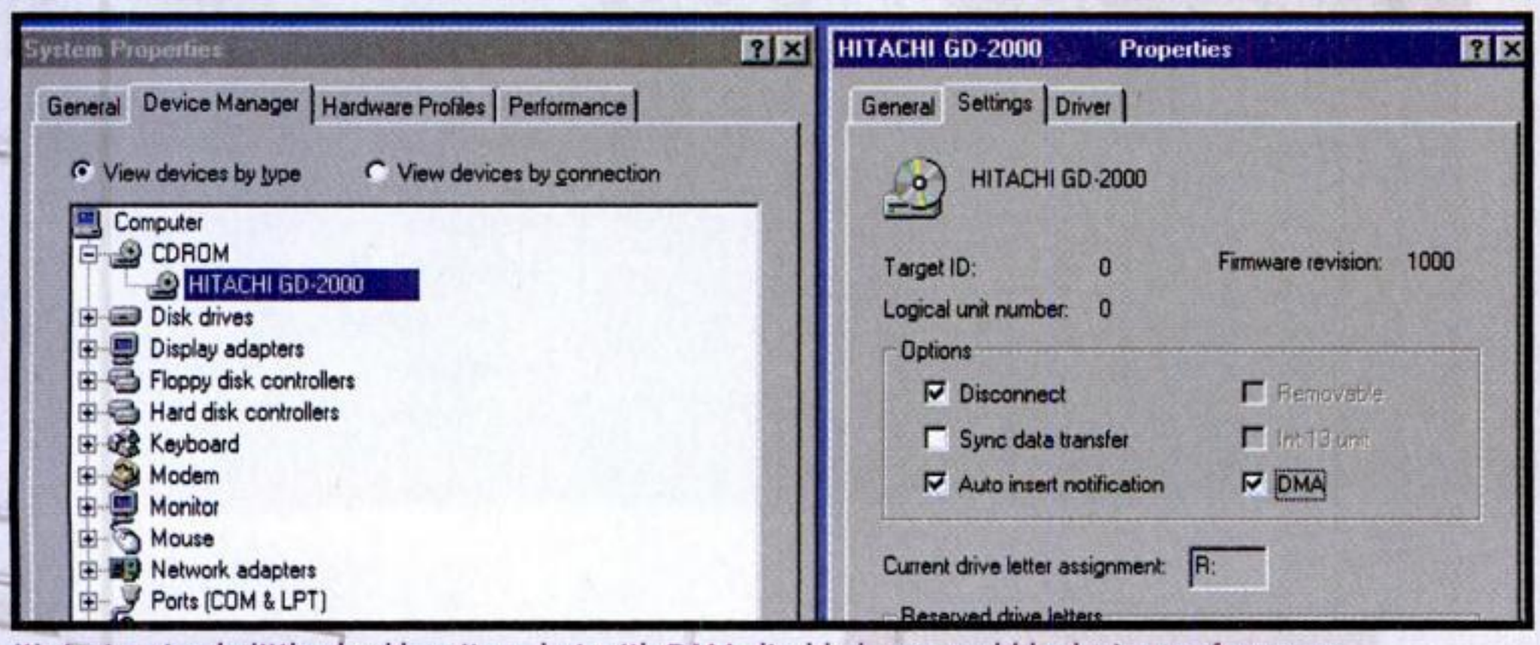
Win98, meanwhile, provides a safe wizard to walk you through to the wonderful world of FAT32. Even though Win98's conversion utility works well, it's still a good idea to backup all your important files, since the conversion is a one-way only process. If you ever decide to uninstall Win98, or set up a dual boot into Linux or NT (which doesn't yet read FAT32), an old-fashioned FDISK or third-party utilities such as *PartitionMagic* are the only ways to switch the drive back to FAT16.

12 Toggle on DMA

HOW IT HELPS Direct Memory Access (DMA) is a memory architecture embedded into your motherboard's core-logic chipset that allows for the transfer of data between system memory and storage drives without stealing precious CPU clock cycles. Without DMA, the system must interrupt the CPU for a minimum of 16 cycles every time it wants to read from, or write to, a hard drive, CD-ROM drive, or DVD-ROM drive. With DMA enabled, however, the system can perform the same task in only two or four cycles. Most new drives are DMA-compliant, but idiot system manufacturers fail to enable the technology.

HOW TO DO IT You can enable DMA by going to your Device Manager under System Properties and double-clicking the icons of each individual storage drive. This brings up the Properties menu for each device. Hit the Settings tab, and if the DMA box is present, make sure it is checked and then restart.

Your BIOS needs to support DMA and have it enabled. For the right BIOS setting, check your motherboard manual for references to IDE transfer modes. Win95/98 also needs the right bus-mastering drivers, which usually come with a new motherboard or machine. Find Intel's standard bus-mastering drivers at **support.intel.com/support.controllers/peripheral/**.



It's just a simple little checkbox item, but with DMA disabled, you could be losing performance.

13 Optimize your display

Begin by going to your Display Properties control panel and setting the optimum resolution for your monitor size. Unless you're doing high-end design work, we recommend 1024x768 for 17-inchers, and 1280x1024 for 19- and 21-inchers. Next, maximize your screen real estate by upping the horizontal and vertical size settings in your on-screen control panel. Now download the *DisplayMate* demo from **www.displaymate.com**, and use the sample screens to adjust brightness, contrast, and geometry.

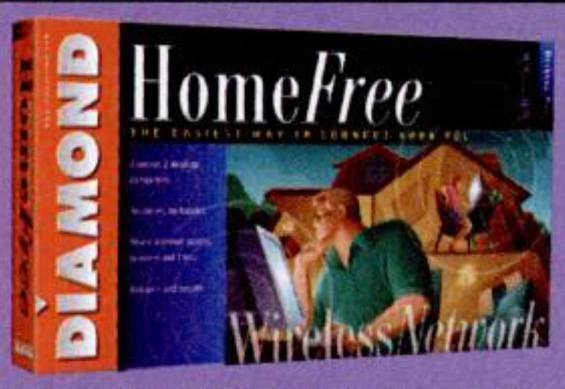
14 Burn in your PC

Most system makers put their machines through a series of component tests before sending out their boxes. This is known as "burning in" a system and ensures that all components work together without conflicts. While low-level component tests are fine and dandy at the factory, nothing beats challenging your new system with *real* software. So before you begin stuffing your hard drive with apps and personal documents, run a looping *Quake II* or *Unreal* demo for a 24-hour period (activate all advanced 3D rendering options and set the game to 1024x768 if possible). This test will stress all subsystems and cause a lemon to reveal bad drivers, bad settings, and inadequate component cooling.

15 Backup DOS drivers

After you've formatted your hard drive or wiped out the Windows directory, nothing's worse than discovering you don't have a boot disk with your CD-ROM drivers. Every Windows 95 user should have a back up disk that'll crank up his CD-ROM drive under DOS. If your drive came without DOS drivers, visit the manufacturer's web site and download the DOS drivers and installation program. From your Windows/Commands directory, you'll also want to copy over the DOS commands Edit, Format, Fdisk, Himem.sys, Mscdex, and Extract, as well as anything else you may need when trapped in the C: world. Windows 98 users have the easiest route to creating a boot disk. Simply go to the Add/Remove Programs Control Panel and select Start Up Disk to create a generic boot disk that'll work with almost any CD-ROM drive.

Welcome to **WIRELESS** home networking.



Introducing HomeFree.—The Easiest Way To Connect Your PCs. Sure, everybody wants a home network. But nobody looks forward to installing one. Thankfully, Diamond's new HomeFree networking solution delivers the freedom and ease of wireless. So you get all the benefits of an office network, with absolutely none of the hassle. With a HomeFree wireless network you can connect all your PCs within 150'. That means quick and easy Web access, printer access, and file sharing from anywhere in your home, anytime you like. Just plug a HomeFree card into your desktop or laptop PC and you're connected! Best of all, HomeFree's exclusive software allows your entire household to surf the Web at the same time, with a single modem and a single Internet account. Quick and easy installation. Instant access to all your PC resources. No more fighting for computer time. All good reasons to visit your nearest retailer and make all your computers HomeFree.

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HomeFree offers unprecedented functionality for computers in the home, creating a complete network without the use of cables.

- Connects both desktop PCs and laptops
- Share the Internet, peripherals and files
- Enables multi-player gaming
- Speed: 1 Mbps
- Range: 150'
- Frequency: 2.4 - 2.4835 GHz
- RF Technology: Spread Spectrum

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16 Optimize MSDOS.SYS

HOW IT HELPS

Windows 95/98 receives startup instructions from MSDOS.SYS, a text file located on the root of your main hard drive, usually C:\. By changing default instructions, you can enable boot options designed for power users and ditch the startup screen they gave you when you enlisted in the Microsoft army.

A large section of MSDOS.SYS contains letters with semicolons in front of them. These letters pad the file, making sure it's larger than 1024 bytes (the semicolons prevent the gibberish letters from being read by the system). The letters are included for certain programs that need to verify the DOS version that's running and can only do so if the MSDOS.SYS file is large enough.

HOW TO DO IT

In older versions of DOS, MSDOS.SYS was an unreadable system file. In Windows 95/98, however, it's a readable ASCII file that's structured like an initialization (.INI) file, making it easy to edit. Most settings can be toggled with either a zero (0) to disable, or a one (1) to enable. Use any text editor to make changes, then restart your machine to enable your handiwork. If the instruction you want to change isn't already in your MSDOS.SYS file, simply add the appropriate syntax under the heading marked OPTIONS. Here's some of our favorite startup tweaks:

`BootDelay=[x] (default is 2)`
This sets the number of seconds of delay before starting Win95. A longer delay count gives you more time to press a function key for specific booting options (see BootKeys).

`BootKeys=0 or 1 (default is 1)`
Enables the startup option keys (F4, F5, F6, and F8). Setting this to 0 prevents any startup keys from functioning. F4 will boot your previous version of DOS. F5 will start the system in safe mode. F6 will step through your CONFIG.SYS and AUTOEXEC.BAT commands one by one. F8 will bring up the boot Menu.

`BootGUI=0 or 1 (default is 1)`
Enables automatic graphical startup into Win95. The 0 setting boots to a DOS prompt (you can then type "WIN" to start Win95).

`Autoscan=0 or 1 (default is 1)`
Setting this to 0 turns off the auto-scandisk on bootup that kicks in when Windows is improperly shut down.

`DisableLog=0 or 1 (default is 0)`
Setting to 1 enables the creation of a bootlog.txt during startup for troubleshooting purposes.

`Logo=0 or 1 (default is 1)`
Setting this to 1 enables display of the Windows95 animated logo. Setting to 0 turns it off, over, and out.

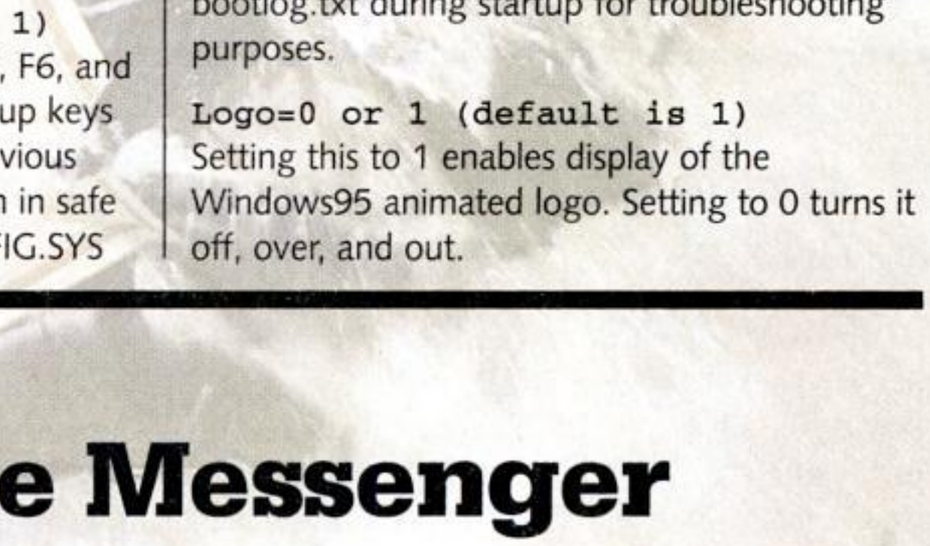
17 Kill the Messenger

HOW IT HELPS

Even though it probably didn't come with your computer, chances are you've installed Netscape *Communicator* and encountered the annoying AOL Instant Messenger (AIM) startup screen that automatically launches whenever you reboot. This seemingly inexorable application can be removed, despite the fact it boasts no obvious instructions that suggest otherwise.

HOW TO DO IT

To disable AIM so that it won't load unless you explicitly launch it, click on the Setup button on the AIM sign-on screen, select the Misc tab, and uncheck "Start AIM when Windows starts." To permanently remove the malignant AIM tumor, open up REGEDIT and remove the AOL Instant Messenger entry found in the Hkey_Current_User\Software\Microsoft\Windows\CurrentVersion\Run key.



We've all seen the anger-inducing first screen, but how many of you have seen the problem-solving second screen?

18 Decompress

You're going to be compressing and decompressing large Internet files all the time, so install *WinZip* and *WinRAR* from the get-go. *WinZip* decompresses the Zip format, is small and easy-to-use, and includes cool right-click and drag-and-drop features that make unzipping a breeze. *WinRAR* works with RAR, a German algorithm that actually allows higher compression ratios than other formats and can create multivolume archives according to size specifications. This allows you to save a single file on multiple floppies. *WinRAR*'s ability to compress mongo-large WAV and AVI multimedia files is unsurpassed. Get *WinZip* from **www.winzip.com**. Get *WinRAR* from **www.geocities.com/SiliconValley/Lakes/2797/#Download**.

19 Disable autoinsert notification

Autoinsert notification tells your machine to read the AUTORUN.INF file located at the root of CD/DVD-ROM and removable storage drives. This file contains instructions for changing drive icons and launching applications. It's a great aid for novices who don't know how to launch installation apps, but not for people who are constantly swapping discs. At *Maximum PC*, we rue autoplay when we simply want to grab a single file off an installation disc. Autoinsert notification can be disabled on a per-drive basis. Go to Device Manager and double-click on the appropriate drive icon. Hit the settings tab and clear the checkmark for auto insert notification.

20 Take a Shortcut

If you're a power user, you'll be using System Properties and WIndows Explorer everyday, so you might as well get to them quicker via desktop shortcuts. For System Properties: Go to Control Panels, right-click System, and click Yes when Windows asks you if you want to create a desktop shortcut. For Windows Explorer: Go to the Settings menu under your Start menu, and choose Taskbar. Click the Start Menu Programs tab, and click Advanced. The Explorer will pop up, listing all the folders located in the Start menu. Click on Programs and you'll see the Windows Explorer icon located at the bottom under all of the folders. Right-click on it and drag it to the desktop to create a shortcut.

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21 Get creative with TweakBIOS

Most motherboards' advanced BIOS settings are hidden. The *TweakBIOS* utility puts these settings at your fingertips, giving you the ability to change memory timings, latency timers, wait states, memory caching, recovery times, bus-mastering settings, and more. In essence, all things that affect system performance. Download the utility from **www.miro.pair.com/tweakbios/index.html**. The shareware version gives you complete access to all functions—except you can't actually apply changes (you'll need the registered version for this). Advanced BIOS settings aren't for the faint of heart, but if you're a seasoned veteran, you can actually boost performance with a few tweaks. (See page 63 for more on BIOS tweaks.)

22 Use proper CD-ROM settings

For optimal performance, CD-ROM cache settings should be set according to your usage habits. Go to the Performance tab in System Properties. Now hit the File System button under Advanced Settings and click the CD-ROM tab. Adjust Supplemental cache size as needed. Small caches are best for multimedia and gameplay; large caches are best for database and CD-ROM access. For the Optimize access pattern control, leave the setting at "Quad-speed or higher."

23 Update drivers—Immediately!

Chances are good that the system you just bought was sitting in inventory for months on end—which means it's loaded with drivers several revisions old. So determine the manufacturers of all your individual components (including your hard drive, CD-ROM/DVD drive, videocard, soundcard, and motherboard) and go to the support sections of each manufacturer's web site and download the latest drivers. New drivers can not only address bugs and glitches, but also add new control panel features and increase performance. Make sure to bookmark each support section, so you can return now and then to look for driver updates. And never install drivers meant for another piece of hardware. This is an open invitation for disaster.

24 Get MIDI Perfect

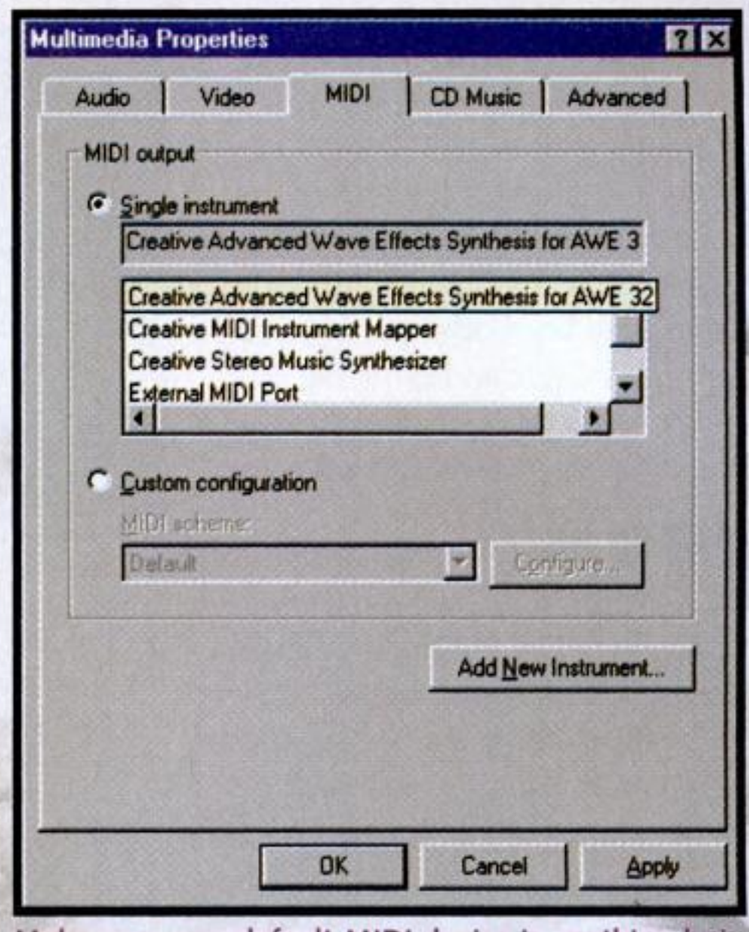
HOW IT HELPS Despite the emergence of DirectSound, many games still rely on MIDI (Musical Instrument Digital Interface) to process their musical scores. Most sound chipsets have two MIDI options, and you must ensure the best option is enabled.

FM Synthesis is short for Frequency Modulation Synthesis. This is the crappiest form of music reproduction, as your soundcard will attempt to interpret each musical instrument via the same wave-modulation technology that came with your circa-1970's "101 Electronic Experiments" kit. Violins, guitars, and other instruments will sound as if they're being played through a kazoo. Very bad.

Wavetable is the preferred MIDI option, as your soundcard will use actual recorded samples of real-life instruments. The samples can be stored within the soundcard's ROM, or in an external daughtercard or free-standing MIDI box. Violins and glockenspiels sound exactly like violins and glockenspiels. Splendid.

The problem is that many manufacturers will set MIDI processing to FM Synthesis by default, even for great wavetable cards. Bah!

HOW TO DO IT Go to Control Panel, open Multimedia, and hit the MIDI tab. If your only choice is FM Synth, you're stuck with crap. But if you have other options, such as "External MIDI Port" or "Internal Wavetable," enable one of the devices, open up a MIDI file, and listen to the tunes (the setting for your wavetable device may be labeled with the name of your soundchip—"Montego Wavetable MIDI" or "Monster Sound MIDI Out," for example). If you go with the external option, but don't hear anything, you may not have an external device hooked up. Also check your MIDI volume control, which may be set too low.

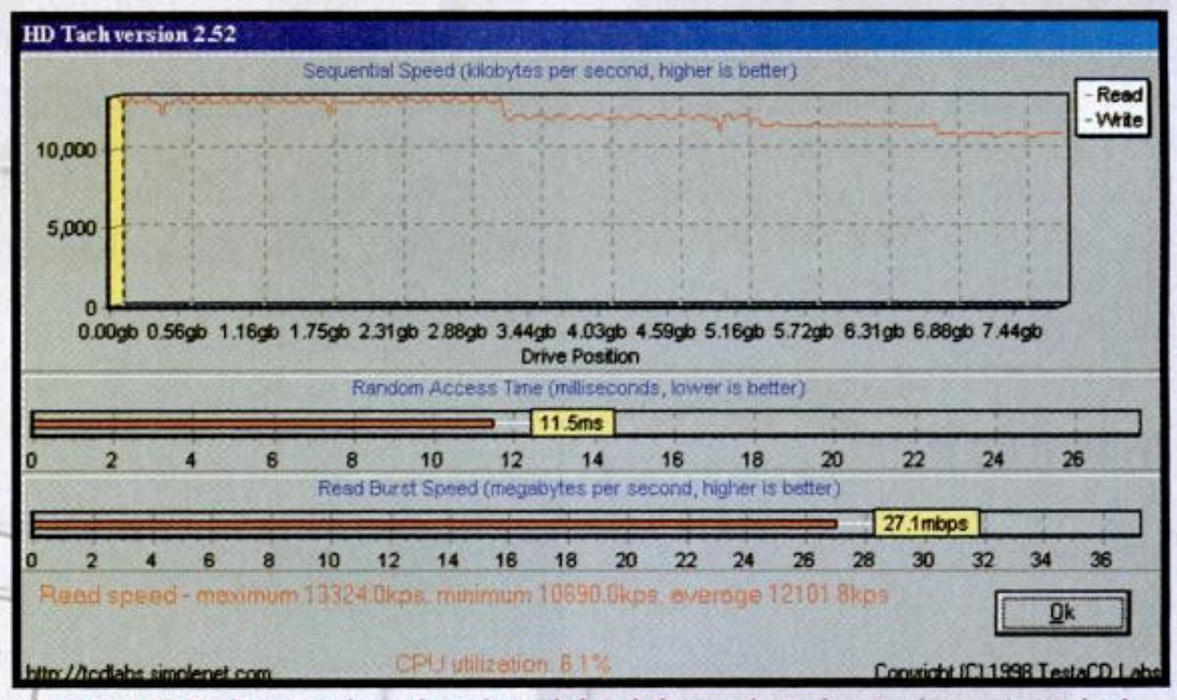


Make sure your default MIDI device is anything but synthesis. In this case, you want the AWE32's own instrument samples.

25 Unload the Bus

HOW IT HELPS If you have a machine with two hard drives, make sure your regular old EIDE hard drive isn't on the same bus with an Ultra DMA drive. When an EIDE drive shares a bus with an UltraDMA drive, the slower EIDE drive will bog the bus down, affecting the faster drive's performance. Slow ATAPI devices like CD-ROM, DVD-ROM, and removable storage drives should also be moved off the primary bus.

HOW TO DO IT Most machines have two buses, a Primary and a Secondary (they're labeled on the motherboard). Your boot drive is always the Master device on the Primary bus. This should be the fastest drive you have, since you'll likely be loading Windows and all your apps from here. If your Secondary bus is empty and you have a second device on the Primary bus, move it to the Secondary bus. You will have to change the Master setting to Slave via jumpers located on the drive.



We use HD Tach not only to benchmark hard drives, but also to determine which drive deserves the Master position on the Primary bus.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com

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READER TIPS

In the September 1998 issue, we asked readers to e-mail in their hottest performance tips. Here's a wafer-thin sampling of the top submissions. We received about 4,000 e-mails, and only considered tips that were fresh, original, and somehow slipped under our radar when we were compiling our own list. In cases where different readers sent in the same worthy tip, we chose the first write-up of the tip to arrive in our in-box.

26 Faster net downloads

If you're using Win95, adjusting the Maximum Transmission Unit (MTU) setting in the Registry can dramatically speed up transmission speeds across the Internet. First, back up your Registry. Now find the MaxMTU setting using REGEDIT's Find function. Right-click on MaxMTU, select Modify, and change the value to 576. Close the Registry and reboot. *—David Roberts*

[Ed: You can learn more about MTU at **www.infinisource.com/maxmtu.htm**.*]*

27 Virtually faster

To get the best swap-file results, temporarily remove all the shortcuts in your Startup folder, go to the Virtual Memory button under the System Properties performance tab, and disable virtual memory. Now reboot, defrag your hard drive, and set your virtual memory minimum and maximum amounts to the same big fat number. Gurus recommend 2.5 times your system RAM, but about 180MB to 256MB is good. To really get it screaming, invest in *Norton Utilities*, and use the speed optimizer to place the swap file at the beginning of your hard drive (the fastest part of the drive).

—Sherwin Vischer

[Ed: This was one of the most popular tips we received. It conflicts with our own swap-file tip on page 55, but it's debatable whether it's best to let Windows set its own swap-file size—it really all depends on the applications you use. Experiment with both tips to determine what works best for you.]

28 Serve me

Go to the Performance tab under System Properties and hit the File System button. Set the typical role of the computer from "desktop computer" to "network server." This usually yields a performance gain in the way Windows allocates resources, leading to more memory being available for applications. *—Jason Poe*

[Ed: Congrats, Jason. You were the first person to send in the most popular tip we received by far. Sort of like the first contestant to ring in with a $100 Jeopardy question.]

29 Caching in

Windows has a cache to store data to be written to the hard drive. It doesn't have a set size and can use up to 31MB of RAM on a 64MB machine. To determine the cache size your computer is using, go to system monitor and add a monitor for disk cache size under memory managers. You will now be given the amount of memory Windows is using to cache disk writes. If you open the SYSTEM.INI with Sysedit and go to the Vcache section, it will be empty. Add the following lines:

MinFileCache=1024 and MaxFileCache=8192

This will set the cache size to 8MB and lower system-resource usage, speeding up disk access. The performance gains are most evident in *Unreal* and while editing *Photoshop* files and other memory-hogging programs. *—Michael E. Davis*

30 Memory timing optimizations

Joe Decker of Ithaca, NY, wins Dream Machine 98 for his concise, well-written, 2,000-word primer on how to optimize BIOS settings. Here's a small taste of his submission. If you're undaunted by the prospect of getting down-and-dirty with your memory settings, go to **www.maximumpc.com** *for the full story—22 tips with background information on all the attendant technology.*

The BIOS controls how all the components in your memory subsystem interact, so adjusting these settings can yield better performance. Before changing anything in your BIOS, write down your current settings in case you crash (or see no performance boost) and need to bring back the original values.

Auto Configuration This setting adjusts all BIOS values to a single default for "best overall performance." Unfortunately, Auto Configuration uses very conservative memory timings that ensure the computer won't freeze or crash while running demanding apps. If you really want to get the most out of your computer, disable this setting. Otherwise, you can't tweak your memory timings.

The Fixed Timing (or Manual) Setting When you enable this setting, you're forced to choose a memory timing that precisely corresponds to the timing of the main memory on your motherboard. As a general rule, there are only three possibilities: 60ns, 70ns, and no value. Using the "no value" will allow you to tweak each of your memory timings separately, which is what we're looking for.

DRAM Read Timing Try the lowest values, and if you don't have any problems after running your most demanding applications, you have the right settings for your memory!

DRAM Write Timing This sets write timings and is applied to both FPM and EDO memory. Try the lowest values possible.

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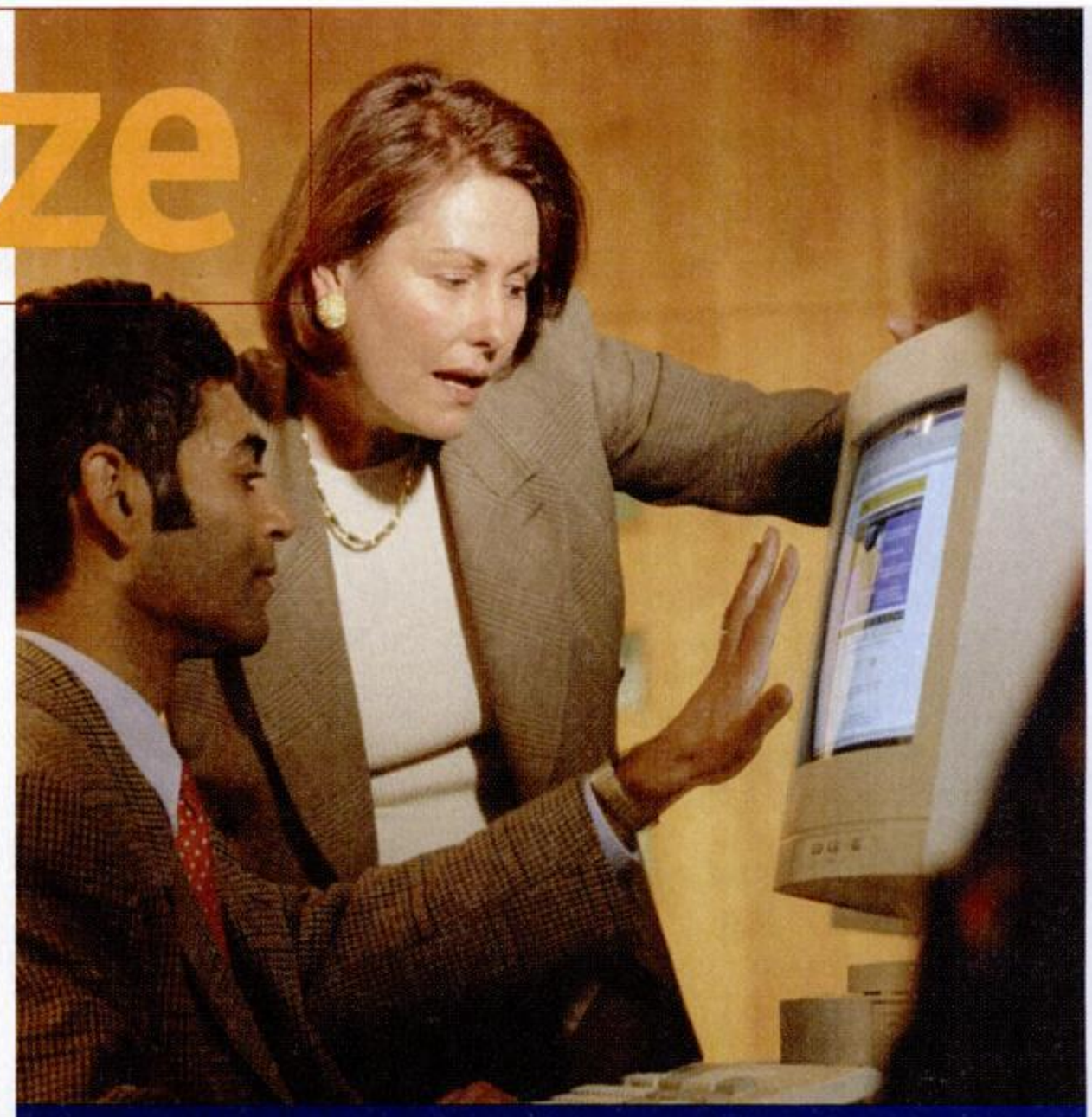

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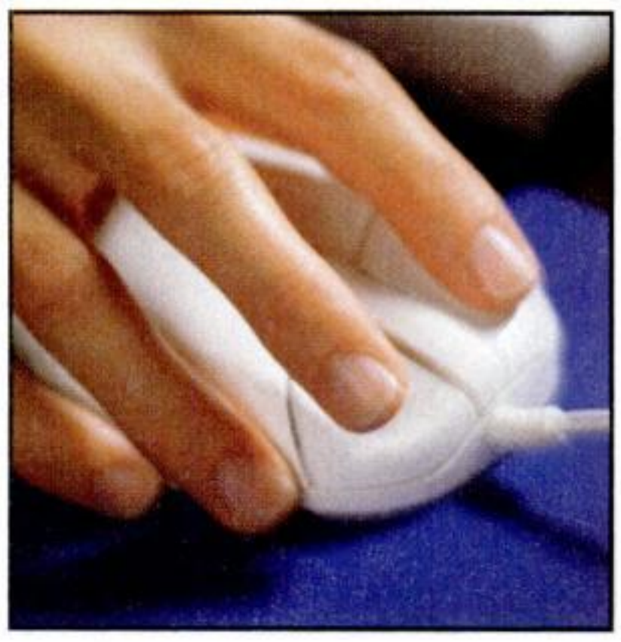

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Fake IDE

I was hoping you could help me with a problem that has Micron's Tech Support stumped. I own a Micron Millennia XKU built around a 300MHz Pentium II, an Intel Atlanta LX motherboard, and a 4.3GB Seagate Ultra DMA hard drive. My hard drive has one FAT32 4GB partition and I'm running Win95 OSR2.

When I try to enable DMA, the hard drive disappears from the Device Manager and a yellow exclamation point appears over my Primary IDE Controller icon. Under performance in System Properties I get the message, "Compatibility mode paging reduces overall system performance. Drive C: using MS-DOS compatibility mode file system."

Why am I having this problem?

—Greg

You've fallen into the compatibility-mode pit. When the IDE controller's 32-bit protected-mode driver doesn't load properly as Windows starts up it falls back to a 16-bit DOS driver. This could be caused by loading the wrong bus-master drivers or by merely enabling DMA on your hard drive. If it happens repeatedly, Windows adds a NOIDE entry to the Registry to prevent future attempts to load problem IDE drivers.

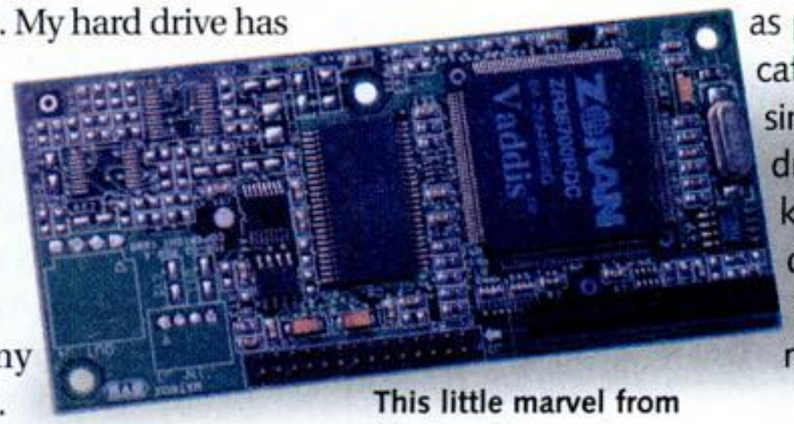
To fix this, use Regedit (in the Windows directory) to remove the NOIDE entry from the HKEY_LOCAL_MACHINE\SYSTEM\CURRENTCONTROLSET\SERVICES\VXD\IOS Registry key.

After you update the Registry, restart Windows so that it can re-initialize the protected-mode driver for the IDE controller. If it doesn't have any problems, the file system and virtual memory will return to 32-bit protected mode and the nasty yellow exclamation point will disappear.

MPEG-2 the Hard Way

Are there noticeable differences between hardware and software MPEG-2 decoding? I don't want to pay the extra cash for a dedicated MPEG-2 decoder card right now. I'd rather wait a couple months until the add-on daughterboard for the Matrox G200 comes out so I can feed my DVD output directly through it. Until then, what sort of software should I use? I have a 350MHz Pentium II that should do software decoding pretty well.

—Jeneral



This little marvel from Matrox slaps onto your G200 AGP board and handles all of your MPEG-2 decoding needs.

Software DVD playback is never quite as good as playback through a dedicated hardware decoder, since software tends to drop frames when it can't keep up with the MPEG-2 data flow. It does this to insure video and audio remain synced.

The video stream coming from your DVD requires a lot of muscle to decode, either out of a dedicated chip (hardware decoding) or your CPU (software decoding). When it's done through software, the strain on the CPU is high, requiring almost 100 percent of its attention, and software decoding needs at least a 333MHz to 350MHz Pentium II to produce playback that isn't jerky. Videocards offering DVD hardware support or daughterboard add-ons lower the CPU requirement (almost down to the 233 MHz to 266MHz level), while dedicated DVD decoders work very well with Pentiums all the way down to 120MHz to 133MHz range.

The software decoder you should use with your Matrox G200 is Zoran's SoftDVD, available from the Matrox Online Store (**onlinestore.matrox.com/products_graphics/softdvd.htm**) for $10. It ships with the Matrox DVD daughterboard (pricing not available as of this writing).

"If you notice that some components aren't updated after installing DirectX 6.0, don't get your boxers in a bunch—this is normal operating procedure."

DirectX Divergence

After experiencing problems with some of my games, I decided to investigate my DirectX 6.0 installation (just in case), only to find that I'm stuck with DirectX 5.0 drivers for both my SB16 soundcard and keyboard, while the rest of my devices use newly installed DirectX 6.0 drivers. Is this normal? How do I fix it?

—Jon

If you notice that some components aren't updated after installing DirectX 6.0, don't get your boxers in a bunch—this is normal operating procedure. Microsoft's attitude when it comes to installing

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the latest and greatest iteration of DirectX is "if it ain't broke, don't fix it." Since both DirectInput and DirectSound fall into this category they didn't go up a version number like the rest of the components.

100MHz Speed Bumps

I'm currently running a 300MHz K6-2 with 32MB of non-PC100 RAM. So far I haven't had any problems, but I'm not sure if using non-PC100 RAM with a 100MHz bus will cause problems or damage the system. I want to add another 64MB or 128MB module and don't know if I should spend the extra cash for PC100 or buy more standard SDRAM. Exactly what is modified on PC100 RAM that makes it "PC100"?

—Luke Brown

If you're running PC66 memory on your 100MHz motherboard and haven't seen any glitches, consider yourself lucky. Most memory modules are designed to operate within a frequency band, such as 60MHz, 66Mhz, or 75MHz, but some of the better PC66 memory can be spec'd to run as high as 100MHz. Keep in mind that running anything, including memory, on the far end of its frequency range will cause it to heat up much faster than normal. We've heard instances of folks running PC66 memory on a 100MHz-system bus machine with no problems and others that seize up tighter than a nun's knickers, so it's a hit-and-miss situation.

Besides being spec'd for even higher speeds (100MHz, 113MHz, or 133MHz), most PC100 SDRAM modules have what's known as a Serial Presence Detection (SPD) module, which allows the motherboard's BIOS to automatically set its internal memory settings for optimal performance.

"We've heard instances of folks running PC66 memory on 100MHz-system bus machine with no problems, and others that seize up tighter than a nun's knickers, so it's a hit-and-miss situation."

PCI Timepiece

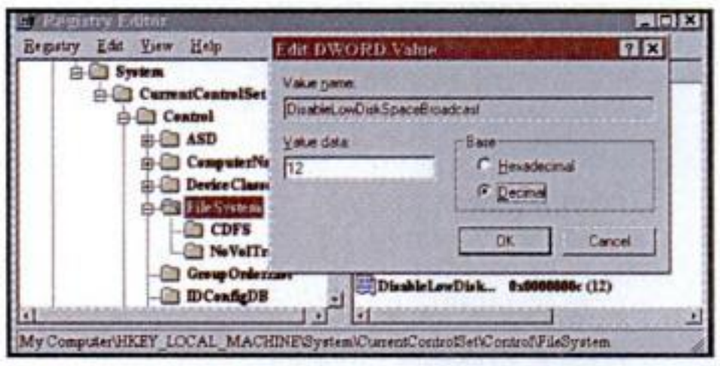
What is PCI latency? I have a brand new ABIT BH6 and there's a PCI latency setting in my BIOS that allows me tweak it—but what should I change it to? What does increasing the PCI latency affect? Will it mess up my ISA bus?

—Andy Berner

Since the PCI bus runs much faster than the ISA bus, the PCI Latency Timer controls how much the PCI bus is slowed so that the ISA bus can be accessed. If you have nothing riding on the ISA bus, you can effectively increase the response of the PCI bus by bumping the PCI latency setting. Keep in mind that the PS/2, serial, and parallel ports are considered part of the ISA bus, so you may not want to touch this setting if you have anything connected to these ports.

Windows Nag-ware

I'm having problems with Windows 98's Disk Cleanup feature and want to know how to disable it completely. The cleanup manager keeps reporting that my hard disk is full but



Back up the Registry before you try something as difficult as disabling the Low Disk Space Notification.

every time I check it I find about 1GB of free space on my drive. Why does Disk Cleanup always tell me that my drives are full? I even reinstalled Win98, disabled all scheduled tasks, and unchecked the "if this drive runs low on space automatically run Disk Cleanup" option from the Disk Cleanup setting box for all my drives, but no luck. As it stands I can't download big files without constantly running Disk Cleanup.

—Jeff

While Win98's Disk Cleanup is a handy place to purge all the flotsam and jetsam from your hard drive, the constant nagging of the Low Disk Space Notification is worse than my mother. Turning off the Disk Cleanup autorun feature doesn't seem to effect the disk-space nag, from appearing whenever it deems your drive incapable of holding what you're trying to stuff onto it. To permanently rid Windows of the disk space nag you have to run Regedit and create a new DWORD value named DisableLowDisk SpaceBroadcast in the Hkey_Local_Machine\System\Current ControlSet\Control\FileSystem key. Set the DWORD value to 4 if you want to disable the notification for your C: drive and 8 for the D: drive. If you want to disable notification on both drives set the DWORD value to 12.

I wish it were that easy to disable the nag feature of my mother.

One, Two, AGP-View

I have a Matrox Millennium G200 AGP videocard. Is there any way to make sure the card's running at AGP 2x instead of 1x? How do I go about setting 2x mode? The motherboard is a Zaapa ZP-5V2 and the manual states that it's AGP 2x compatible.

—John Norris

Apart from trusting a videocard's specifications, there really isn't a surefire way to tell whether a card is running in AGP 1x or 2x. However, you can test for AGP direct memory execution (DME) by benchmarking your rig's AGP feature set and extrapolating from there. 3DMark 99 from Futuremark has a great AGP test, in which it forcefeeds

3DMark 99 takes 16MB worth of 256x256 pixel textures and makes your AGP card suck it down.

up to 32MB of 256x256 pixel textures down your AGP card's gullet. If you're getting single-digit framerates out of this benchmark on your supposed AGP 2x/DME card, something is seriously amiss.

Caching Out and Speeding Up

I have a 430VX motherboard with a P200 MMX and 80MB of EDO RAM. I've heard this motherboard can't cache more then 64MB. Is the extra 16MB doing more harm than good in terms of game speed and/or looks?

—Shodan

This depends on what benchmark you hold near and dear. For apps that depend a lot on L2 cache and memory caching performance, such as server software, you may see a performance hit. Even our own bootMark runs slow when benchmarking a TX or VX chipset with more than 64MB RAM on board. But in apps that eat memory for lunch, such as *Unreal* and *Photoshop*, having more memory means less hard drive thrashing due to virtual memory usage, resulting in faster renders and smoother framerates.

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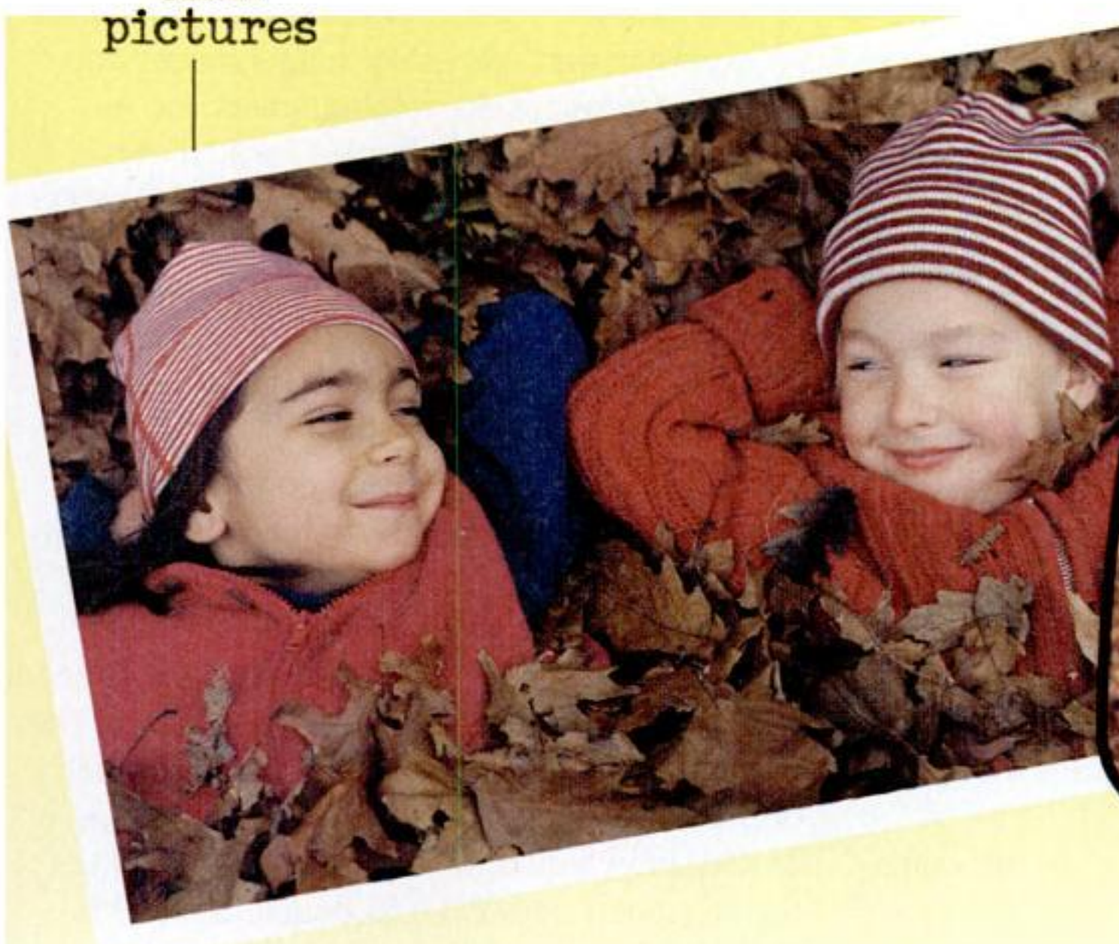

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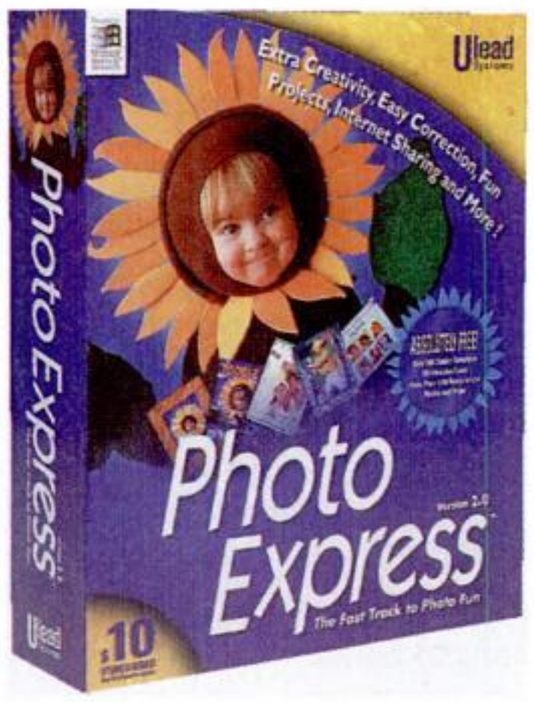

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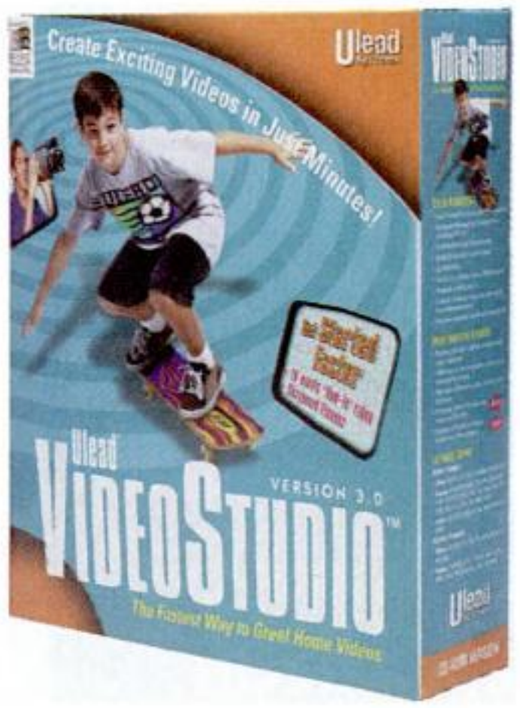

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- Intel Katmai 68
- ATI Rage 128 . . . 70

A Chip Called Katmai

Intel's 3D CPU doesn't reach its full potential

Intel was bushwhacked last summer when AMD's K6-2 processor introduced 3DNow! technology to speed up 3D graphics. Now Intel's Katmai New Instructions (KNI), promise technology that can rip through 3D graphics twice as fast. Unfortunately, Intel's first KNI-infused processor will take only partial advantage of KNI.

The processor is currently code-named Katmai, but will get a fancier name before launching on March 1. It's the latest member of Intel's P6 family, which also includes the Pentium Pro, Pentium II, Celeron, and Xeon. Katmai is almost identical to those chips, but adds a few new features:

- 70 additional instructions (KNI) to accelerate 3D graphics and multimedia.
- Eight new registers to support KNI.
- New memory streaming instructions that pump data through the CPU faster.

Like many other P6 processors, Katmai will come in a Single-Edge Connect cartridge for Slot 1. Inside the cartridge is 512K of Level 2 cache running at half the core CPU frequency (initial CPUs will run at 450MHz and 500MHz). Katmai will work with existing 440BX system chipsets, and appear in mid- to high-end PCs throughout the year. KNI technology probably won't work its way down to Celeron-level prices until 2000.

KNI vs. 3DNow!

Inevitably, people will compare KNI to 3DNow!. The competing extensions have three things in common:

- Both speed up 3D graphics and multimedia by ramming data through the CPU more quickly. The technique is called Single Instruction Multiple Data (SIMD). A single program instruction performs the same operation on two or more pieces of data, where before a program needed multiple instructions.
- Both extensions focus on floating-point data—specifically, the single-precision (32-bit) floating point that's so critical for 3D. This is an important distinction from MMX, an earlier extension that speeds up integer processing.
- Both extensions do nothing unless you're running optimized software. For KNI, this means either an optimized version of DirectX (6.1 or later), optimized videocard drivers, or, in a best-case scenario, optimized game or application code.

Although *Maximum PC* hasn't benchmarked a Katmai system with final drivers yet, on paper it appears KNI is technically superior to 3DNow!. KNI's 70 instructions are much more comprehensive than 3DNow!'s 21 instructions, and KNI registers are twice as wide as 3DNow!'s.

Notice we state that KNI is *technically* superior to 3DNow!. In practice, it's a different story. The Katmai CPU doesn't fully exploit the potential of the KNI extensions. To take full advantage of KNI, Intel would have to redesign the CPU's floating-point unit (FPU) to double the width of its pipelines, and that would delay the chip's debut. So Intel compromised: Katmai has the same FPU as any other P6 chip and uses only half the capacity of KNI.

Katmai can still execute twice as many single-precision floating-point operations per clock cycle as other P6 chips—a big boost for 3D. But Katmai's limitations erase much of the advantage it should have over AMD's K6-2, K6-3, and K7. A critical part of 3D is a mathematical process known as geometry transformation, which requires a CPU to multiply and add thousands of numbers. At identical clock speeds (say, 500MHz), Katmai and a K6-2, K6-3, or K7 will crunch those numbers at the same rate, even though KNI has a theoretical two-to-one advantage.

Result: With 3D graphics, it'll be a closer fight than it *should* be when Katmai goes head-to-head against a 3DNow! CPU. And even if Katmai wins, it won't be a blowout. Intel usually has an edge in clock speeds (thanks to better manufacturing technology), so the fastest Katmai chips should

KATMAI VS. 3DNOW!: REGISTERS

Katmai Register

Register #1	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #2	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #3	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #4	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #5	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #6	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #7	32-bit operand	32-bit operand	32-bit operand	32-bit operand
Register #8	32-bit operand	32-bit operand	32-bit operand	32-bit operand

128-bits wide

3DNow! Register

Register #1	32-bit operand	32-bit operand	80-bit FP
Register #2	32-bit operand	32-bit operand	80-bit FP
Register #3	32-bit operand	32-bit operand	80-bit FP
Register #4	32-bit operand	32-bit operand	80-bit FP
Register #5	32-bit operand	32-bit operand	80-bit FP
Register #6	32-bit operand	32-bit operand	80-bit FP
Register #7	32-bit operand	32-bit operand	80-bit FP
Register #8	32-bit operand	32-bit operand	80-bit FP

64-bits wide

80-bits wide

Katmai instructions can store four 32-bit operands in each 128-bit register and have exclusive use of the registers. 3DNow! instructions can store two 32-bit operands in each 64-bit register and must share the registers with MMX and regular floating point (FP) instructions. Only the latter use the full 80-bit width of the registers.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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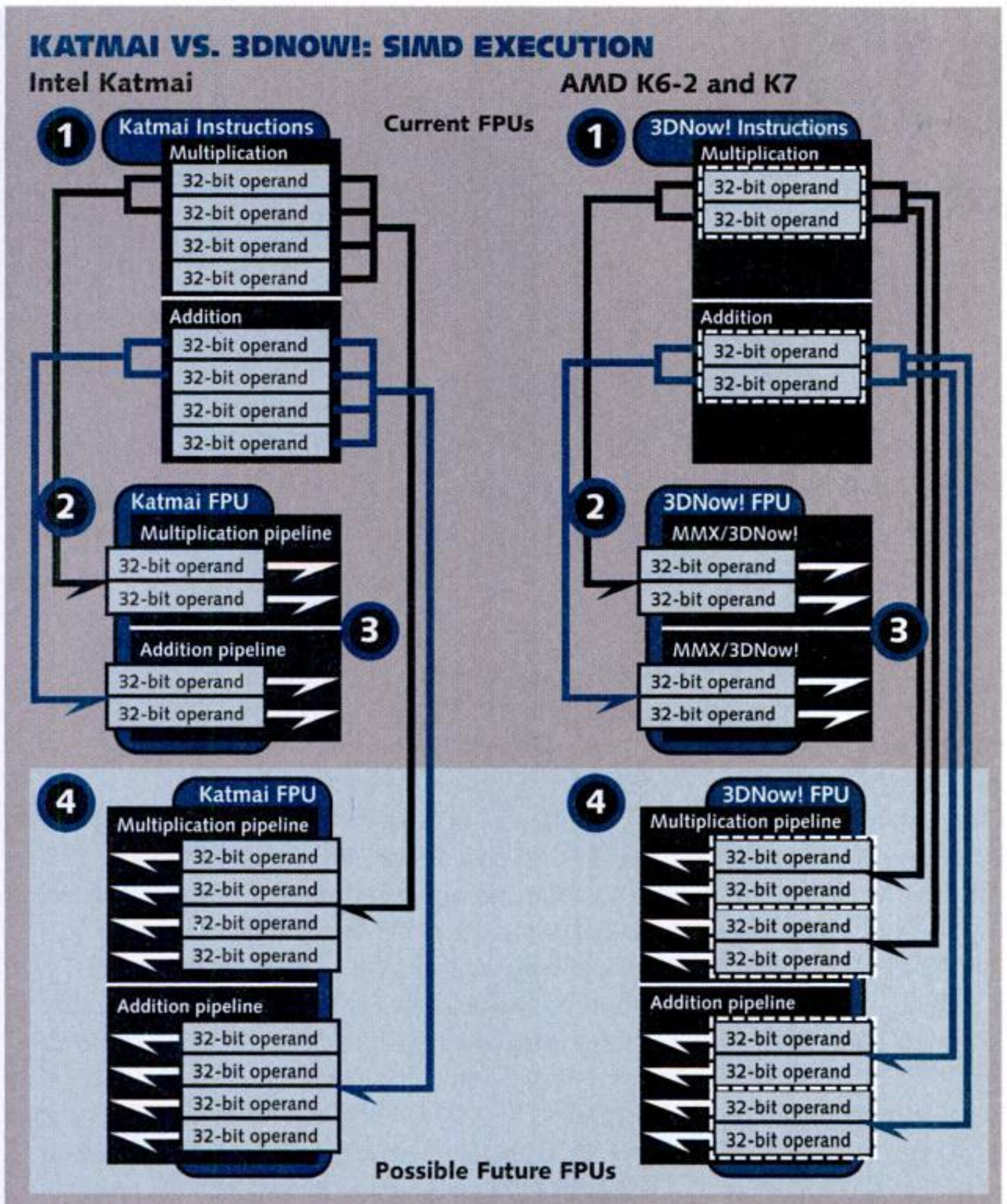

1. Katmai instructions can have four 32-bit operands. 3DNow! instructions can have only two 32-bit operands. **2.** Katmai's floating-point unit (FPU) has a 64-bit multiplication pipeline and a 64-bit addition pipeline, so each pathway can handle only two 32-bit operands per clock cycle. The K6-2 and K7 have dual 64-bit pipelines for MMX and 3DNow! instructions, and each pathway can handle two 32-bit operands per clock cycle—the same as Katmai. **3.** Output for both Katmai and K6-2/K7 is two 32-bit multiplications and two 32-bit additions per cycle. **4.** Future Katmai FPUs could have wider pipelines to handle all four operands per instruction. This would double performance and still use only two Katmai instructions per cycle. Future 3DNow! processors could have wider pipelines to double performance, but this would require four 3DNow! instructions per cycle.

outrun the fastest 3DNow! chips. And KNI's larger instruction set will make a difference, too. Against that, 3DNow! has three advantages: the chip costs less, it doesn't require an OS upgrade, and it has a headstart in the marketplace.

In the future, when Intel tweaks its FPUs to fully support KNI, 3D performance will double again. Even AMD's new K7 won't match that. 3DNow! is handicapped because each instruction can handle only two 32-bit operands to KNI's four. So AMD, Cyrix, and Centaur must either improve 3DNow! or adopt KNI in future processors. The second option seems more logical because it would ensure full compatibility with Intel.

KNI also enables a technique called memory streaming, which essentially allows a program to pump data through the CPU's caches more efficiently. It works so well that Katmai can encode MPEG-2 video in realtime—a much more demanding job than *decoding* MPEG-2 video in realtime. Memory streaming support is something developers must write into their programs; it does nothing for existing software.

Redefining the x86

Katmai's new instructions and registers are the most important extensions to the x86 since Intel stretched the architecture from 16 bits to 32 bits in 1985.

Registers are memory cells in a CPU that temporarily store numbers to be manipulated by program instructions. One thing that defines a CPU architecture is the layout of its registers. It's not something to change lightly because it affects software and OS compatibility.

KNI adds eight registers to the x86. Each register is 128 bits wide. Most x86 registers are only 32 bits wide. MMX and 3DNow! registers are 64 bits wide, and regular floating-point registers are 80 bits wide. The extreme width of KNI registers is significant, because it means a single register can hold four 32-bit numbers. And the most important numbers in 3D graphics are 32-bit floating point (FP) values, also known as single-precision FPs.

KNI registers are genuinely new registers. That's not true of the "new" registers added by MMX and 3DNow!. Those registers are actually mapped onto the x86's existing FP stack, which has eight 80-bit registers. (MMX and 3DNow! use the lower 64 bits of each 80-bit register.) Because MMX and 3DNow! must share the FP stack with regular FP instructions, mixing all those types of instructions together can cause problems. KNI registers avoid that trouble because they're not shared.

Intel's new registers force OS changes. When you alternate between multitasking programs, the OS and CPU must perform a context switch. The OS saves the contents of the CPU's registers before switching to the next program, then restores the registers when you switch back to the first program. If a CPU has new registers the OS doesn't know about, those registers won't get saved, and the program that relies on them will crash. That's why Intel has been working with OS vendors to make the necessary modifications. Stay posted for information on which OSes fully support KNI's new registers.

All told, Katmai is a worthy addition to the P6 family, and KNI opens the door to even greater performance in the future. Let's just hope software developers embrace KNI as they did 3DNow!—not the way they did MMX.

—Tom R. Halfhill

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ATI Rage 128

Trying to blast TNT

With a whopping 32MB of local memory, the ATI Rage Fury is gunning to toss TNT to the curb.

The race to topple the current king of the 2D/3D hill is on, and ATI's leading the attack against nVidia with its Rage 128 chipset. ATI is quick to avoid slapping the "TNT killer" moniker on its new silicon bundle, but with specs like these, you know comparisons to TwiN Texel are inevitable.

- AGP 2x/direct memory execution or PCI 2.1
- dual-graphics-pipeline engine
- 0.25-micron fab
- 128-bit memory interface
- support for up to 32MB of SDRAM or SGRAM (125MHz at a 128-bit memory path), or Double Data Rate (DDR) SGRAM
- 8-bit stencil buffer
- 16-, 24-, or 32-bit accurate z-buffer
- 8K on-chip cache
- integrated DVD/MPEG-2 decoding
- 230MHz or 250MHz RAMDAC

With that dual-graphics pipeline comes the inevitable single-cycle processing of two textures. Also expect support for Direct3D/OpenGL 3D effects such as bi/trilinear mip-mapping, anisotropic filtering, vertex and table-based fogging, and more.

ATI is also proud of its Triple Cache Architecture, which allows for texture, pixel, and z data caching. This should result in faster performance on both the 2D and 3D side of graphics, and keep data closer to the graphics processor.

In 2D, expect fill hardware acceleration for bitblts, line draw, and polygon/rectangle fill. Also, you can get hardcore with DVD playback without having to resort to dedicated MPEG-2 decoders.

Two flavors of Rage 128 will be available: the add-in-card-based Rage 128 GL and the Rage 128 VR, a motherboard-based solution. Four boards will be sold using Rage 128 technology.

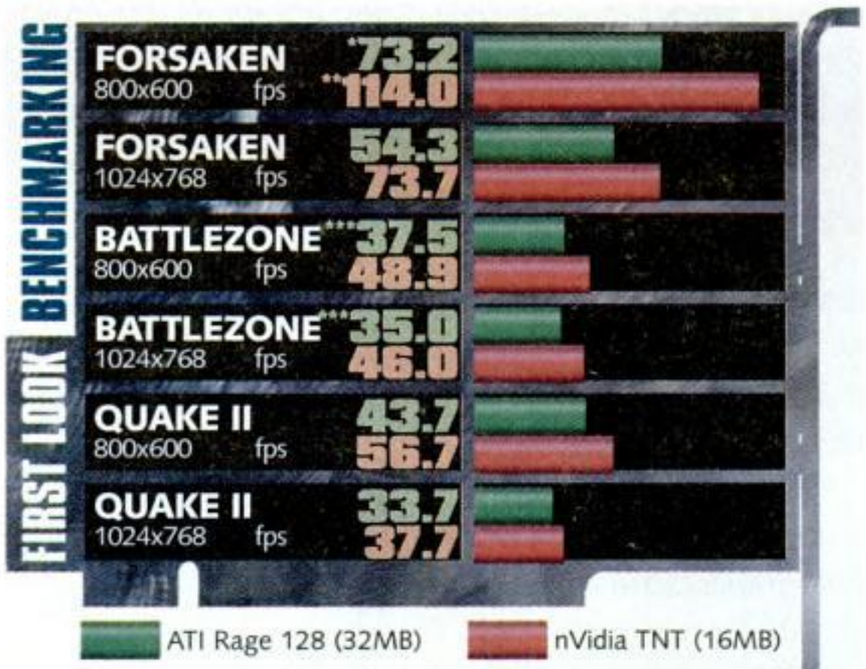
- **Rage Fury.** With 32MB of local memory and TV-output, this will be ATI's high-end enthusiast card.
- **Rage Magnum.** Designed for the OEM community, it will also carry 32MB of SDRAM
- **Xpert 128.** This will become the new entry-level board with 16MB of nonupgradable local memory.
- **An All-In-Wonder using Rage 128.** This board will come with a TV-tuner and all the I/Os you've grown to love with the All-In-Wonder line.

With a 32MB Rage Fury and early beta drivers, we took the Rage 128 through our benchmarks. Unfortunately, the provided drivers acted the fool under countless instances, so we were forced to benchmark using a 75Hz refresh rate—the highest the driver would allow us to set. While we expect the 800x600 *Forsaken* score to rise once we get rid of the refresh-rate bottleneck, the 54fps at 1024x768 *Forsaken* proved good, but not grand.

And what of the Rage 128's 32-bit rendering performance? We tried *Quake II* using a 32-bit color depth and got interesting results. While *Quake II* clearly showed it was going to use a 32-bit color-depth output, it would do so using only a 16-bit accurate z-buffer. Regardless of color depth, we'll refrain from giving any final word on visual quality until we see final silicon and drivers, but we did notice a lot of dithering when viewing textures, especially on 16-bit textured games such as *Half-Life*.

It takes more than sheer benchmark scores to topple the king, and if ATI can't fix these glaring visual deficiencies, TNT may just have the last blast after all.

—Andrew Sanchez



NOTE: Benchmarks are based on a proprietary preview card and may vary from actual card manufactured. As always, V-Sync is enabled. *Score bottlenecked by refresh rate. **With a refresh rate of 140Hz. ***Triple buffering disabled.

PRODUCT AVAILABLE

Price $299 (estimated retail price for Rage Fury)
Company ATI Technologies
Phone 905.882.2600
URL www.atitech.com

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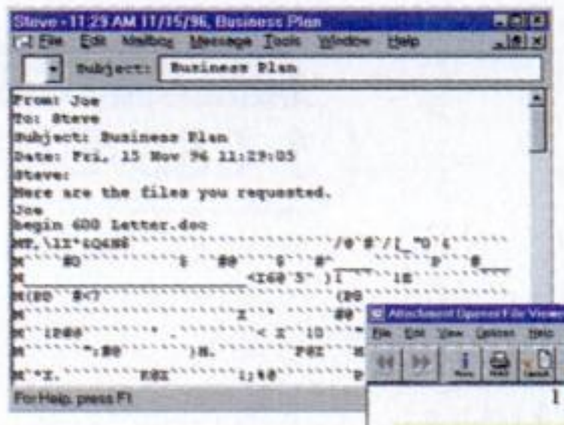

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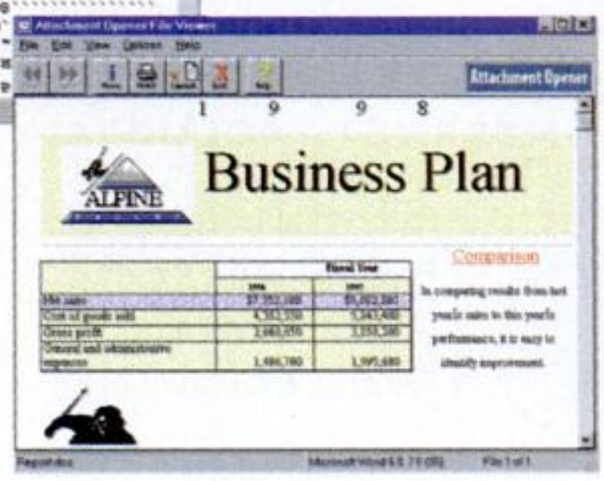

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Testing Policy ▶

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the Maximum PC lab by Maximum PC editors, and, whenever possible, we use real-world applications to gauge performance. Our final verdicts are based on benchmark results and a subjective appraisal of product features.

Real-World Benchmarking

Our benchmarking charts are simple: The farther right the bar reaches, the better the hardware performed. Here's the deal on specific benchmarks.

▶ **CPU/MOTHERBOARD** Based on Symantec's System Information benchmark, the bootMark tests low level motherboard components.

▶ **WINDOWS APPS** BAPCO's SYSmark98 uses task scripts in popular productivity and content creation apps to test system performance. The Official Score is based how fast the system can complete all tasks.

▶ **HARD DRIVE**
HD Tach measures multi-threaded hard drive performance. We publish the average 16k read score in megabytes per second.

Other Benchmarking

▶ **OPENGL** *Quake II* tests the 3D accelerator (along with its OpenGL drivers) and the CPU's floating-point. Using demo2.dm2, final score is in average frames per second at 800x600.

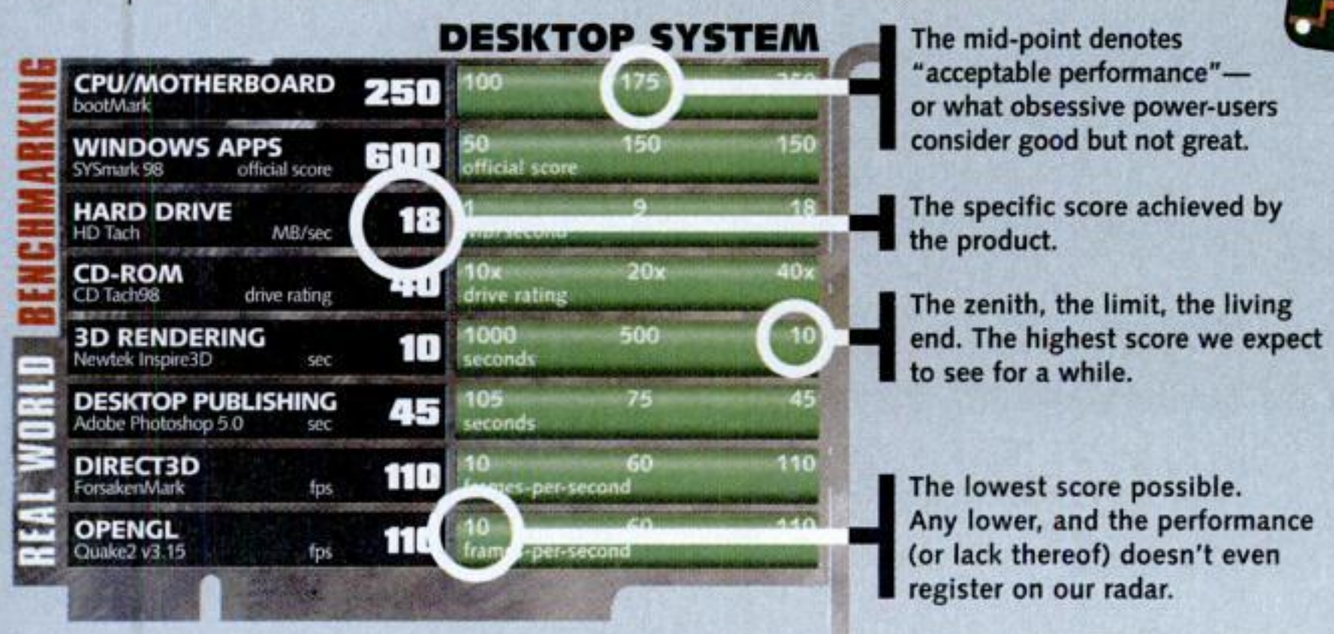
▶ **CD-ROM**
CD Tach measures CD-ROM read times and CPU utilization. We publish the drive's cumulative speed rating (e.g., 24x).

▶ **3D RENDERING**
We use Newtek *Inspire3D* to render a complex ray-traced scene. Final score is in total seconds from start to finish.

▶ **DESKTOP PUBLISHING** In a scripted Adobe *Photoshop 5.0* test, we record how long it takes to apply various filters to a control image. Final score is in total seconds from start to finish.

▶ **DIRECT3D** *Forsaken* is a space shooter that tests the system's Direct3D accelerator. Final score is in average frames per second at 800x600.

EDITOR'S CHOICE AWARD:
Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.



KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by
AARON LAUER

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Compaq 5600i

Leads the way on new technology

Compaq's put so many features in its latest Presario, it's almost like getting the computer for free.

PLUSES

- Flat-panel connector on graphics card
- 1394 connections that don't take up PCI slot
- Very stable
- User friendly
- Cool multimedia keyboard
- Generous software bundle

MINUSES

- Mediocre speakers
- Unforgiving IRQ 11
- Bad software DVD playback
- Welded-shut PCI back plane

Back in 1993, Compaq's first Presario delivered one of the first user-friendly, out-of-box experiences. In 1995, Compaq made some cost compromises that rendered the Presarios as slow as molasses and caused them to fail numerous benchmarks. But thanks to a new wave of product managers who believe performance is as important as price, Compaq has morphed into a technology innovator.

Case in point: The 5600i is the first PC we've seen to include a home-networking connection, a 10/100 Ethernet connection, *and* a shielded DSL modem. It also has two 1394 connections on the motherboard, as opposed to Sony's VAIO (reviewed in December 1998), which handles 1394 via a PCI card.

The two 1394 connections let you attach a source and capture directly to the computer's hard drive. And because the system packs a meaty 14.4GB IBM UDMA drive, you can capture television-quality video without a separate SCSI card and A/V-rated drive (saving at least $1,200). The problem with Compaq's approach is that you need twice the hard disk space to render your edits. (We prefer Pinnacle Systems' approach to digital video, which only renders transitions, not the entire clip.) The 5600i also comes with Asymetrix's *Digital Video Producer 5*.

As for the system's audio, the JBL three-piece speaker system is passable, but it's not in the same league as the Midiland S2s that come with the DragonFire reviewed on page 86. The plastic-encased satellites have a small tweeter inside for better sound at higher frequencies, but the regular speakers made bothersome vibrating noises during gunfire sequences in gameplay. The Diamond Monster Sound II, using Aureal's Vortex 2 chip, almost makes up for the speaker's shortcomings. You get a software-based equalizer, support for software DVD decoding, and four discreet channels for close-to-true AC3 performance.

With so many rockin' amenities, including an nVidia TNT graphics board that gives you incredible 2D and 3D performance, how could you go wrong with the 5600i? In several ways. The most disappointing aspect of the system was the DVD playback. Mediamatics *DVD Express 4.0*, a software-based player, played video at full screen and full motion, but the picture quality was some of the worst we've seen, with significant aliasing around text and straight lines, and artifacts on solid backgrounds. And we couldn't get it to work until we kicked the color settings down to 16-bit. We were also disappointed that the PCI card mounting rack was practically welded shut, and that the system really wants to hold on to IRQ 11. While it may not seem like the end of the world to lose IRQ 11, it's very important for some add-in boards.

Still, we have to give the 5600i kudos for stability. It never crashed during our benchmark and video-capture tests.

Compaq just needs to drop in a hardware DVD decoder, add some better speakers, fix that PCI back plane, and relinquish IRQ 11 to make a kick-ass PC.

—Rick Popko

UNDER THE HOOD

THE BRAINS

CPU	Intel Pentium II 450MHz
L2 Cache	512K
RAM	128MB 100MHz SDRAM (expandable to 384MB)
Motherboard	Compaq ATX with Intel 440BX chipset
Drive Bays	Four 5.25-inch (two free), one 3.5-inch
I/O ports	One parallel, mouse, keyboard, four USB, two 1394, 10/100 Ethernet, home-networking connection

DISPLAY

Video	nVidia Riva TNT with S-Video out
Monitor	Presario MV900, 19-inch (17.9 viewable) .26mm dot pitch
Res/Refresh	1600x1200/72Hz@32-bit

STORAGE

Hard Drive	IBM DTTA-371440 14.4GB UDMA
CD/DVD	Compaq EIDE DVD SR-8583
Removable	Floppy, Iomega Zip
Fax/Modem	Lucent V90+DSL Wildwire modem

SOUND

Sound	Diamond Monster Sound II MX300 PCI
Speakers	JBL Pro Premium three-piece with two satellites and a sub, plus two JBL monitor-mountable speakers

OTHER

Multimedia keyboard with one-touch Internet and CD audio controls

THE BUNDLE

Asymetrix Digital Video Producer 5.0 | Intel Video Phone | McAfee VirusScan | Encarta | Works | Money | Word | Quicken

BOOT 1:36 DOWN 0:04

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD	bootMark	205
WINDOWS APPS	SYSmark 98 official score	176
HARD DRIVE	HD Tach MB/sec	12.2
CD-ROM	CD Tach98 drive rating	21.5x
3D RENDERING	Newtek Inspire3D sec	498
DESKTOP PUBLISHING	Adobe Photoshop 5.0 sec	73
DIRECT3D	ForsakenMark fps	96.3
OPENGL	Quake2 v3.15 fps	57.7

MAXIMUM PC VERDICT

Price $2,800 with monitor
Company Compaq
Phone 800.345.1518
URL www.compaq.com

8

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EXPANSION NOTES

The Presario 5600i has two free PCI slots (one a shared ISA). Compaq could have squeezed one more in there, but a raised circuit board between the top and bottom PCI slots precluded it.

EXPANSION MAP

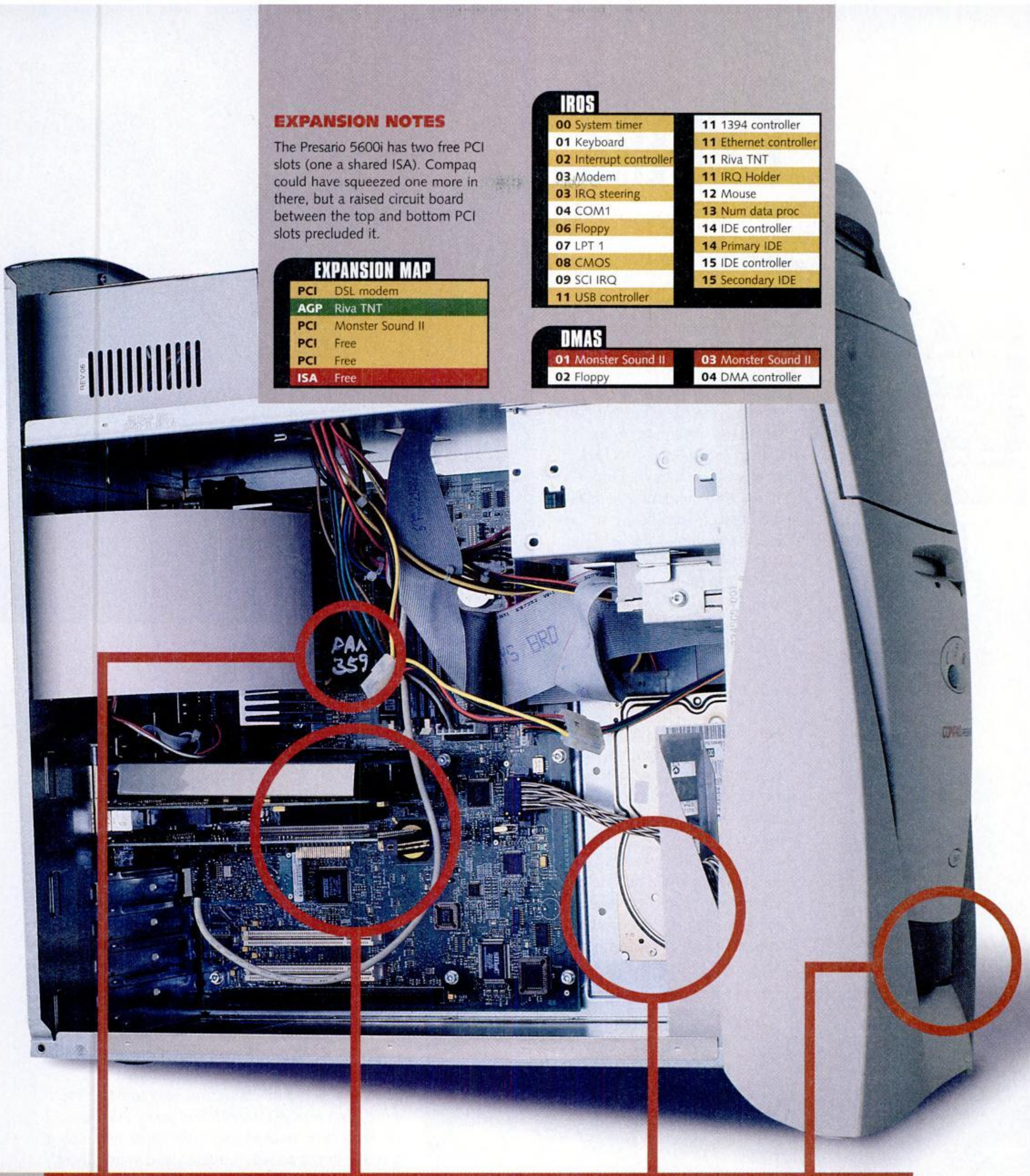
PCI	DSL modem
AGP	Riva TNT
PCI	Monster Sound II
PCI	Free
PCI	Free
ISA	Free

IROS

00 System timer	**11** 1394 controller
01 Keyboard	**11** Ethernet controller
02 Interrupt controller	**11** Riva TNT
03 Modem	**11** IRQ Holder
03 IRQ steering	**12** Mouse
04 COM1	**13** Num data proc
06 Floppy	**14** IDE controller
07 LPT 1	**14** Primary IDE
08 CMOS	**15** IDE controller
09 SCI IRQ	**15** Secondary IDE
11 USB controller	

DMAS

01 Monster Sound II	**03** Monster Sound II
02 Floppy	**04** DMA controller



It's a Magical Mystery Chip We have no idea what this chip is for. We've never seen a PAN 359 before, if that's really the name of the chip, which looks suspiciously like Compaq labeled the thing with whiteout.

Do you have protection? The shielding around the Lucent DSL modem serves two purposes: it reflects heat off coming from the processor on the board above, and it protects the modem from interference generated by the cards around it.

Drive Me up the Wall In an effort to free up drive-bay space, Compaq has taken to mounting its hard drives on the internal wall of the machine.

Fire it Up Like Sony's VAIO, Compaq has 1394 connections on the front and back of the computer. But unlike the VAIO, which takes up a PCI slot, Compaq's solutions built into the motherboard.

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Half-Life

It's all good

Few games transcend mediocrity and bash down the doors of greatness—*Half-Life* is one such game. Unlike *Quake*'s mindless corridor rampage, *Half-Life* is equal parts action and adventure. Ammo is limited, so you'll have to find other ways to frag your foe. Also, there's a fair amount of jumping and object manipulation, so über-fraggers may dislike *Half-Life*'s more adventurous spirit. You'll have to mix up your attack strategies to survive—there are no Runes of Invulnerability or Quad Damages here.

As scientist Gordon Freeman working deep within the underground Black Mesa complex, your workday takes a hard right-turn into hell when top-secret experiments go awry, unleashing a blood-thirsty menagerie of nasty critters. Only your wits, stealth, and effective use of weapons and cover will save the day.

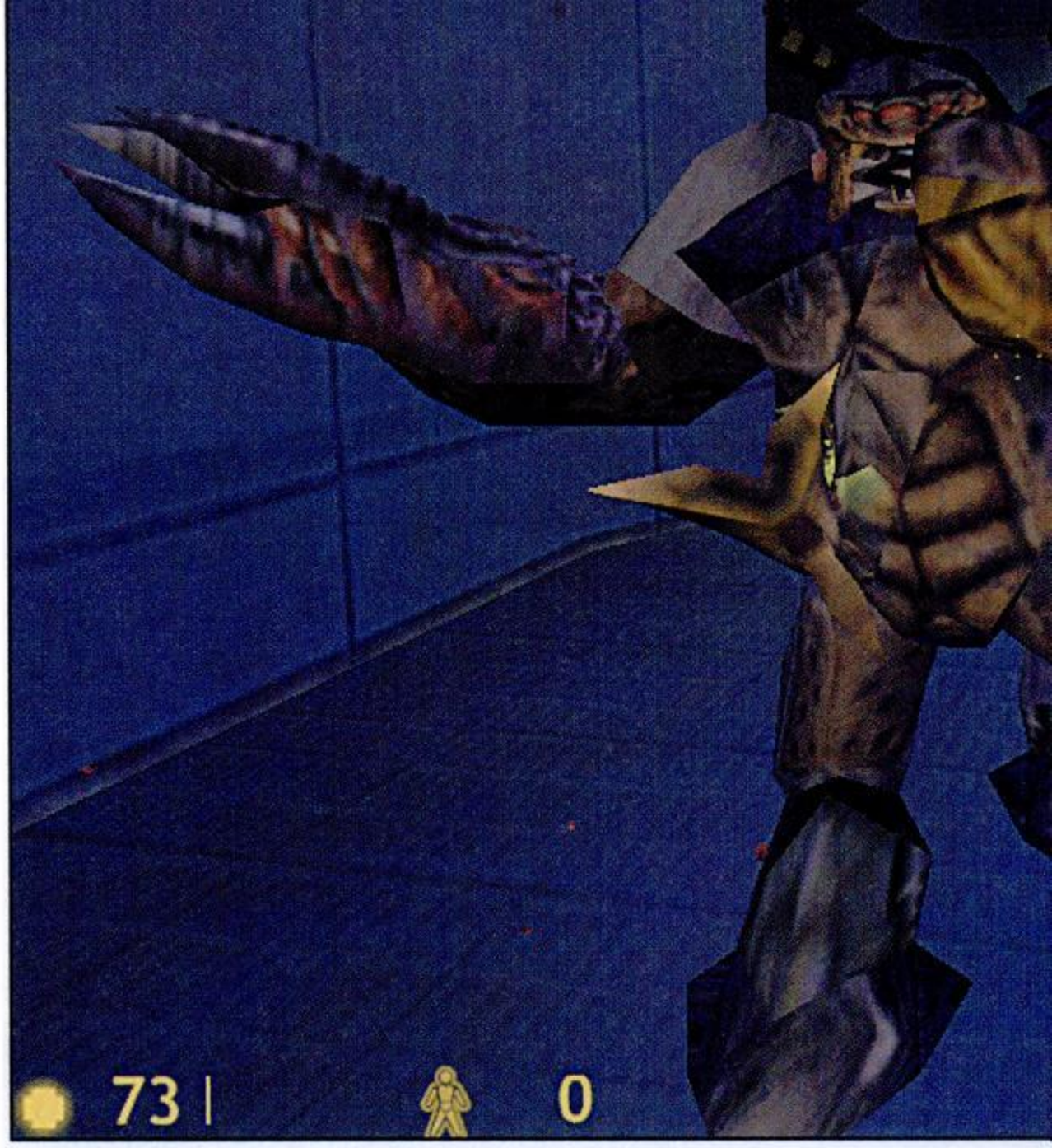
Fighting your way back to the surface is a bone-chilling affair, but the scenery makes it all worthwhile, thanks to Valve's choice of 3D-polygon engine. *Half-Life* took the best that *Quake* and *QuakeWorld* had to offer and taught it a thing or three, with a staggering list of tweaks and optimizations. For starters, *Half-Life* is the only Quake-tech game to support *both* OpenGL and Direct3D. For peak performance, we recommend the OpenGL option (with its multi-textured lighting), although the D3D isn't shabby. Either way, *Half-Life* packs all the expected visual tricks, including alpha-blended water and glass, procedural texturing for blood-splattering effects, and even cool spark effects. Unfortunately, the clean, bright, and varied textures are limited to 256x256. But they do run in either 16-bit or 24-bit depth for even crisper colors.

Rather than traditional multipiece polygon models, *Half-Life*'s models are made up of a single mesh. This is then wrapped in a single texture and animated via skeletal mapping for realistic motion with no visible seams or joints. And each model has twice (roughly 400/800) the polygon count of a normal game, such as *Quake*. These beefier models sport animated facial expressions, long missing in first-person shooters. But these aren't just animated textures—*Half-Life*'s mouth movements are fully animated polygons.

The arsenal, from the typical shotgun to the alien Hivehand spewing living projectiles, keep *Half-Life* fresh. But what good are all these delectable death-dealers without some moving targets? Enter *Half-Life*'s much-vaunted artificial intelligence.

Half-Life challenges the notion that a programmed AI is predictable and easy to beat. The virtual denizens react so lifelike, you'll wonder whose brain is hooked up on the other end. Lob a grenade into a squad of soldiers and watch them scramble for cover. Likewise, a squad leader may yell "fire in the hole" as a grenade bounces into your lap. And if the humans weren't bad enough, the extraterrestrials are even worse. Each species has its own traits—some retreat when confronted alone, but will turn around and attack with the proper reinforcements. Their sophisticated AI beats the stuffing out of *Shogo*'s anemic intelligence any day of the week.

To safely traverse these darkened corridors, you'll need to keep a keen ear open for the soldiers' radio chatter, gurgling alien noises, and ominous footsteps. A host-based reverb/echo combined with 3D positional support via A3D and



Talk about a close encounter—Half-Life's denizens are thirsting for scientist meat.

THE SPECS

3D CARD SUPPORT
- OpenGL
- Direct3D

3D SOUND SUPPORT
- Aureal A3D 2.0
- Creative Labs EAX

MULTIPLAYER
- TCP/IP
- IPX

PLUSES
- Quake engine supports both Direct3D and OpenGL
- Unsurpassed immersion
- Equal parts action and adventure
- Outstanding enemy AI
- Excellent level design
- Excellent monster design
- Facial animation
- Well-balanced weapons
- Easy-to-use multiplayer hook-up

MINUSES
- There's an ending

Gorgeous alpha-blends and wild alien attacks await you.

Your journey will take you to distant alien worlds.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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EAX make *Half-Life*'s acoustics rock.

Start to finish, *Half-Life* is a cinematic gaming experience like no other. Forget crappy pre-rendered FMV drivel—*Half-Life* uses the actual game engine to seamlessly move the story along, all from a first-person perspective.

At times, prescripted actions restrain your role to that of a hapless voyeur. As you try to piece together what the hell went wrong, you'll stumble onto scenes of horrific carnage: fellow scientists being attacked by parasitic head-crabs, a guard's mangled corpse being cut in two by a stray laser, elevators full of escapees plunging down deep shafts. But when you can intercede, you won't have to adventure alone—*Half-Life*'s NPCs help out in your quest. Fellow scientists might be able to heal your wounds and security officers can be convinced to provide cover fire.

And ample cover can be found in the design of the Black Mesa complex, which is excellent, with catwalks and air vents spanning upcoming levels and environmental hazards that require traditional puzzle solving. And the lag between nodes within the game has been minimized so it doesn't intrude on the action.

Titanic alien terrors are just around the corner—just don't run out of ammo!

Not everyone wants a piece of Gordon—this security guard is here to help.

Is *Half-Life* perfect? No. For all the attention to detail in most areas, little details such as seeing the weapon while you climb ladders takes away from the immersion. And while the interaction in *Half-Life* is reminiscent of *Duke Nukem 3D*, with breakable soda machines, usable microwave ovens, and even a hand dryer, this interactivity dwindles as the game goes on. Also, you may encounter the once-in-a-blue-moon clipping problem and floating body. While we applaud Valve for its D3D implementation, lag plagued the single-player mode with certain video-cards—but this seems to be more of a driver-specific problem.

Also, multiplayer can get laggy, but it's so easy to hook up and frag someone, thanks in large part to *Half-Life*'s alliance with the World Opponent Network (WON). Rather than snooping around and learning an IP address, a simple one-click process connects you to the carnage quickly and efficiently.

With its grand one-player odyssey and easy-to-use multiplayer aspect, *Half-Life* goes down in history as a massive shock wave that rattles the first-person shooter genre to its core. It will become the new benchmark by which all other games will be judged. *Half-Life* is as close to perfection as you'll ever see.

—Andrew Sanchez

MAXIMUM PC VERDICT

Price $55
Developer Valve
Publisher Sierra Studios
Phone 800.757.7707
URL www.sierrastudios.com

10

SiN

Feel the punishment

Don the dreadlocks of John Blade and kill lotsa mutants in *SiN*, the latest first-person shooter shivering in *Half-Life*'s all-encompassing shadow.

Using *Quake II* as its rendering backbone, *SiN*'s bright, crisp 16-bit palettes and high-res textures make for great visuals. Monsters and humans are all richly textured, as are the weapons. Mission objectives are told through engine-generated cinematics and sparse text. Some of the cinematics are cheesy (when will game developers quit relying on that wacked circling camera?). Come on, where are the close-ups? No mouth animation results in showroom dummies conveying information.

Cool features, such as location-specific damage, are lost in a sea of bugs and inconsistencies. How the first shipping version got by QA is beyond us, but the original *SiN* was plagued with ridiculously long load times, weak enemy AI and scripting, and cinematic cut-scene glitches. Activision recently released a patch, but the massive overhaul involved renders all saved games useless. Attention to detail is also spotty. While we dig the usable computer, we hate that Blade's hands aren't rendered when he's driving the ATV. During multiplayer, no matter what model you use, you're cursed with Blade's burly hands. We didn't know Elexis Sinclair (the lusty, busty villain in the story) had such manly mittens!

Not even lush 16-bit textures and gibs galore can save SiN.

Some folks will forgive *SiN* no matter what's been said. Had this product shipped with its bugs fixed (as it should have), it would have fared better. But asking a person to throw away valuable time and money just because a developer couldn't get its act together in the first place is unacceptable.

MAXIMUM PC VERDICT

Price $47
Developer Ritual
Publisher Activision
Phone 310.255.2000
URL www.activision.com

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Blood 2: The Chosen

Crimson tides

Caleb is back and shedding more gore in Monolith's *Blood 2: The Chosen*. The second LithTech-powered game, *Blood 2* continues its messy quest toward becoming the most violent first-person shooter ever to drip across your 3D accelerator. Yet another evil bloke is trying to put Caleb six feet under.

Blood 2 looks a lot prettier than it's engine-mate, *Shogo*. Its dark futuristic world seethes with beautiful, high-res textures and lush colors. Museums are brilliantly lit in green and red hues, while cool lighting effects and texture tricks accurately simulate lightning flashing through stained-glass windows. LithTech does all your favorite Direct3D tricks, including alpha-blends, semi-transparencies, and water effects. Other cool effects include persistent bullet holes and a realtime point-of-view distortion. The smoothly animated motion-captured characters and crisply textured polygon meshes also shine brightly. The monstrous menagerie is impressive, with some of the once-human creatures bordering on the grotesque.

Brilliant colors and dual-fisted gunplay make Blood 2: The Chosen a winner.

Classic gunplay is back, including an enhanced, double-fisted-gun mode. High-powered weapons call for high-powered digital sound effects, and *Blood 2* rocks the house. Sub-machine guns clatter and shotguns blare, while Caleb's off-the-wall commentary is always good for a chuckle. The interactive digital music also fits the dark, morbid mood to a tee.

In-game cinematics are done more tastefully than in *Shogo*—at least the circling maneuver isn't beaten to death here. Still, the storyline is told via static text screens and nonanimated facial textures. Don't expect anything as immersive as *Half-Life*.

These shade-wearing hoodlums are about to feel some pain.

Blood 2 breathes new life into multiplayer ruckus. A quasi-RPG element lets you customize your character's visuals and adjust speed, focus, strength, and resistance, to best suit your gameplay style. Also, you can customize your weapon arsenal, then save your custom configs and bring them into any multiplayer game.

We were pleasantly surprised to find out *Blood 2* packs much multiplayer goodness, and the over-the-top weaponry makes for some intense firefights. And yes, the announcer is back.

Unfortunately, *Blood 2* has its share of bugs, including an x-axis reversal bug when zooming in with a sniper rifle. There's still that nasty clipping problem, and multiplayer still suffers from lag. Enemies react smarter than *Shogo*'s bumbling buffoons, but they're still a far cry from *Half-Life*'s and *Thief*'s far superior AI algorithms.

Despite these flaws, *Blood 2*'s dysfunctional sense of humor, combined with blood-thirsty graphics and gameplay, will satisfy your dark cravings.

—Andrew Sanchez

THE SPECS

3D CARD SUPPORT
Direct3D

MULTIPLAYER
TCP/IP
IPX
Modem

PLUSES
- Great graphics and sound via the LithTech engine
- Mindless bloody mayhem
- Cool announcer during multiplayer

MINUSES
- Clipping problems
- Lag in multiplayer
- X-axis sniper rifle big really annoying

MAXIMUM PC VERDICT

Price $39
Developer Monolith
Publisher GT Interactive
Phone 425.739.1500
URL www.lith.com

8

TNN OUTDOORS PRO HUNTER

Oh my God. They killed Rudolph!

On the other end of the blood-letting scale, we have this little doozy of a game. We never thought the Unreal engine could look so horrible, but *TNN Outdoors Pro Hunter* proves a game can suck no matter how much 3D technology it has under the hood.

TNN Outdoors Pro Hunter makes Microprose's rancid *Klingon Honor Guard* look good. The list of graphic depravities is endless: while your hunting vistas and victims are rendered via texture-mapped polygons, weapons are blocky sprites, textures shimmer off mountainsides, and trees are bitmapped sprites. The trees often seem to float around the environment—especially when you look up and down. Small creatures simply disappear without a trace when killed, while larger beasts plop dead as a doornail—where's the twitching? The resulting graphical mish-mash will choke even the mightiest systems down to sub-teen framerates. Too bad, because the fauna you hunt is actually modeled and textured realistically. The AI is stupid as a rock—we've witnessed rabbits and elk repeatedly run into a wall.

Control is also funky—a limited x-axis mouse look and basic movement are all you get. You can't crouch or jump.

The hurt doesn't stop there. There's no way to inverse your mouse x-axis, and many of the menu options you've taken for granted in *Unreal*, such as resolution change, aren't labeled. You're left to guess when you fiddle with that resolution slider.

If this is what hunting is really like, sign us up for a knitting course. *TNN Outdoors Pro Hunter* is about as appealing as sniffing squirrel scat. This is the nadir of first-person shooters.

MAXIMUM PC VERDICT

Price $30
Developer DreamForge
Publisher ASC Games
Phone 203.655.0032
URL www.ascgames.com

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Thief: The Dark Project

Who goes there?

MAXIMUM PC KICK-ASS! product

Fulfill those kleptomaniac urges with Eidos's *Thief: The Dark Project,* a first-person jaunt that melds nail-biting suspense and lush 3D graphics into one immersive gaming experience.

As Garrett, a wily pickpocket, you loot a medieval world where ancient magic collides with steam technologies, creating gaming environments filled with shadow-bound streets, alleyways, and darkened corridors. Wonderfully rendered in full, texture-mapped polygon glory, *Thief* uses harshly lit stained-glass textures and extreme shadows, making for dark and moody adventuring.

Under Looking Glass Studios' Dark engine, *Thief*'s visual panache goes feature-for-feature with the LithTech, Quake, and Unreal engines. Expect all those cool visual effects to dance across your Direct3D-compliant accelerator, such as alpha-blended water, localized light-sourcing, and filtered textures. Performance-wise, if you have a fast CPU and Direct3D accelerator in tow, you shouldn't have a problem running Thief at 1024x768 at a smooth 24fps+.

Close combat is handled superbly in Thief: The Dark Project.

Some poor guard is about to taste your blackjack—say goodnight, Gracie.

Friends and fiends move with realistic grace thanks to *Thief*'s motion-capturing techniques. The only thing missing to complete the immersion is facial animation. The game looks dark and gloomy because it is, but don't adjust your gamma correction just yet—darkness is your friend in *Thief*.

You have a sword in Thief: The Dark Project, but don't rely on it.

You're a stalker, not a fighter. As you move through the shadows, the fear of getting caught dominates your actions. Some of the scariest moments involve you crouching in the shadows as palace guards stalk the hallways, looking for the source of some unknown noise. Leaning around corners is also an important tactic. But darkness is your best weapon. We've survived close encounters with guards who were mere inches from us by simply standing perfectly still in the darkness. That's not to say enemy AI is dumb—on the contrary, *Thief*'s AI is among the best we've seen, with guards outflanking you and cutting you off as you try to run away from encounters. Close combat via sword is executed superbly—LucasArts should take notes on incorporating *Thief*'s manual blocking and slashing techniques for future installments of *Jedi Knight*.

Sound is invaluable within *Thief*'s dark corridors. Very few games can claim this. As you tiptoe through the shadows, you must be aurally aware, lest you get caught and mashed to pulp. Listen carefully—eavesdropping on conversations proves an invaluable way to retrieve mission-pertinent info. Stepping on different materials changes your sonic signature, so you'd best tread lightly on metal gratings and tile.

If you're blessed with a quad-channel soundcard, expect maximum speaker usage and excellent music.

But *Thief* isn't perfect. Unless a door is completely closed, an enemy might continue to walk through it. This was done, according to Looking Glass, to keep the AI from getting hung up on doors it just opened. There's the occasional clipping problem too. Some folks may be disappointed that *Thief* lacks multiplayer capabilities, but it was designed as an all-consuming single-player experience from the get-go. Still, we would have loved to see some "Capture The Flag"–style thief vs. thief action where competing guilds try to steal artifacts from each other's citadels.

Despite its imperfections, *Thief: The Dark Project*, with its stellar concept and excellent execution, is an engrossing adventure that demands immediate attention. Put *Thief: The Dark Project* on your list alongside *Half-Life* as an adventure you must partake—larceny has never been so much fun.

—Andrew Sanchez

THE SPECS

3D CARD SUPPORT
Direct3D

SOUND CARD
DirectSound 3D

PLUSES
- Great visuals via Direct3D and proprietary Dark Engine
- Very strong storyline
- Lush environment
- Unique gameplay stands out from other first-person jaunts
- 3D positional sound rocks
- Outstanding enemy AI
- Excellent level design and execution

MINUSES
- Funky "enemy through the door" code
- Occasional clipping problem

MAXIMUM PC VERDICT

Price $50
Developer Looking Glass Studios
Publisher Eidos Interactive
Phone 415.547.1200
URL www.eidos.com

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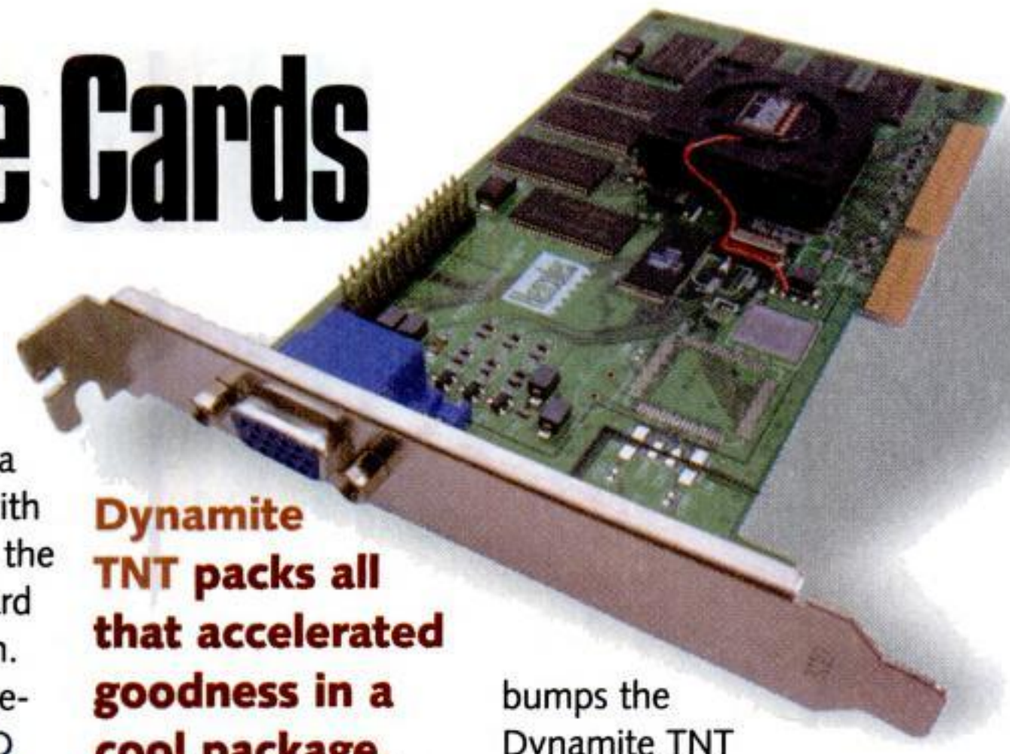
A Tale of Three Cards

Riding the AGP bus

Hercules Dynamite TNT



Dynamite TNT packs all that accelerated goodness in a cool package.

THE SPECS

MAX 24-BIT RES/REFRESH RATE
1920x1200/60Hz

MAX 16-BIT RES/REFRESH RATE
1920x1200/75Hz

AGP?/LEVEL
Yes/2x

BUNDLE
Drivers for Win9x and NT | Hercules Touch control panel

PLUSES
- Lower price
- Fast Forsaken/single-cycle rendering performance
- Drivers allow for specific D3D and OGL adjustments

MINUSES
- Slight OpenGL graphic glitch (occurs in other TNT boards)
- No TV out

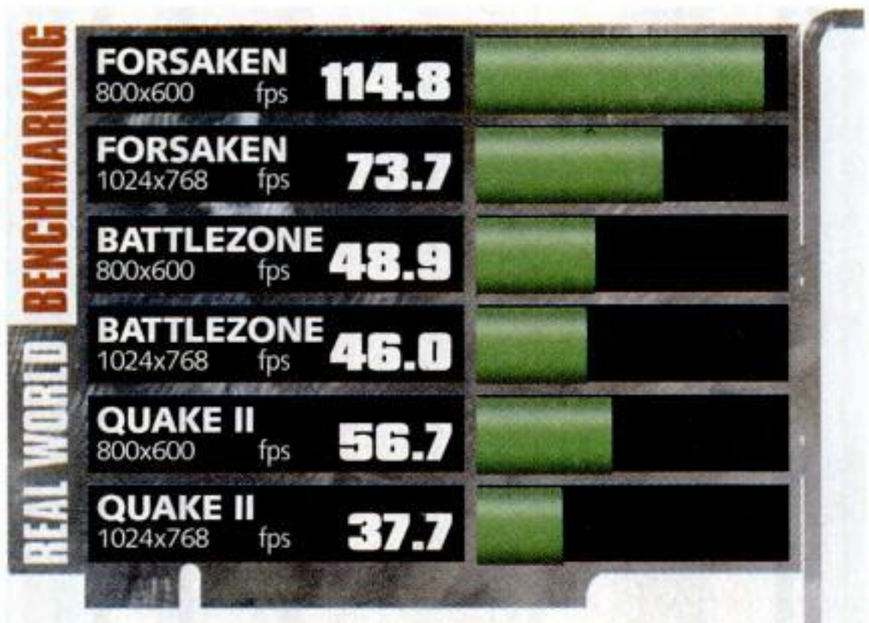
This TwiN Texel–powered videocard opts for a simple design devoid of TV output. Armed with a 250MHz RAMDAC and 16MB of SDRAM, the Dynamite TNT follows nVidia's reference board design, with the addition of an integrated fan.

Hercules' Touch control panel gives you one-touch access to your settings. Specific Direct3D and OpenGL options, such as mip-mapping levels and texture quality, can also be tweaked. And despite the fan, there's no overclocking slider.

The Dynamite TNT outperformed all other TNT boards we've seen under Direct3D. An excellent 114fps on the single-pass rendering ForsakenMark bumps the Dynamite TNT past the 104fps other TNT cards spewed. The Dynamite's *Battlezone* scores are also marginally faster. Unfortunately, the march toward benchmark-busting goodness stumbled under OGL. The 56.7fps at 800x600 *Quake II* is a hair slower than other TNT boards tested. Visual quality under D3D games remains crisp, although we did encounter problems under *Half-Life*, where textures would either disappear or become distorted. This seems to be a TNT-wide problem, though, so we hope nVidia is fixing it.

Despite that, the Hercules Dynamite TNT's great D3D performance means you too can get wiggly with nVidia without shelling out the big ducats.

—Andrew Sanchez



* V-Sync enabled for all tests, and refresh rates set to the highest the videocard allows.

MAXIMUM PC VERDICT

Price $149
Company Hercules
Phone 800.532.0600
URL www.hercules.com

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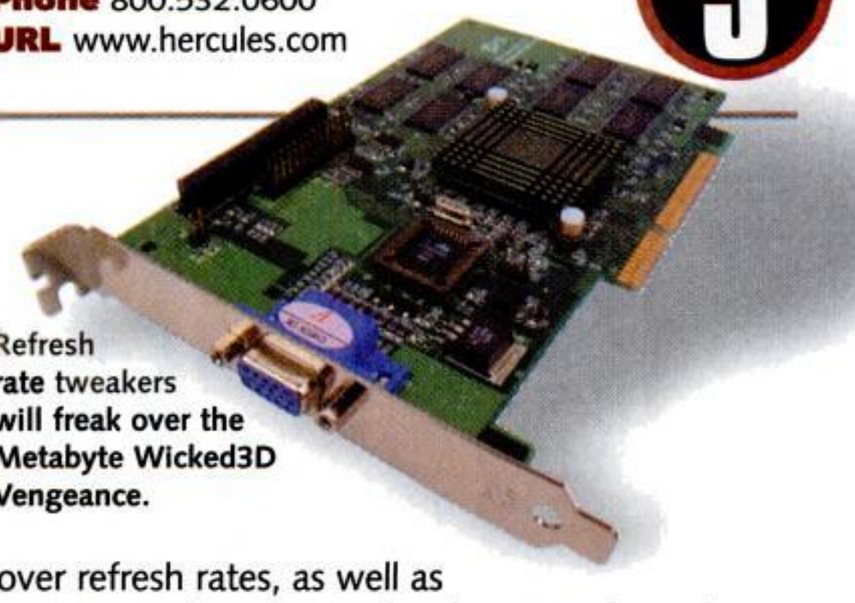
Metabyte Wicked3D Vengeance



Refresh rate tweakers will freak over the Metabyte Wicked3D Vengeance.

The Wicked3D Vengeance is based on 3Dfx's 128-bit Banshee chipset and comes armed with 16MB of local SDRAM. Metabyte opted for a TV-output-less board to keep pricing down, while the board layout follows standard Banshee reference design.

Metabyte is known for tweaking its video drivers, and the Vengeance is no exception. On top of the reference drivers sits the Re2Flex control panel, which allows 1Hz-interval-precise control over refresh rates, as well as custom resolutions. Besides that, Metabyte also tacked on H3D 3D-shutter-glass support.

The Vengeance performed unevenly, with framerates limited to half the current refresh rate. As of this writing, 3Dfx has yet to release a full OpenGL ICD, and GL performance is a hair beneath other Banshee boards tested.

The Wicked3D Vengeance is too overpriced and underpowered to garner serious consideration.

—Andrew Sanchez

THE SPECS

MAX 24-BIT RES/REFRESH RATE
2000x1500/160Hz

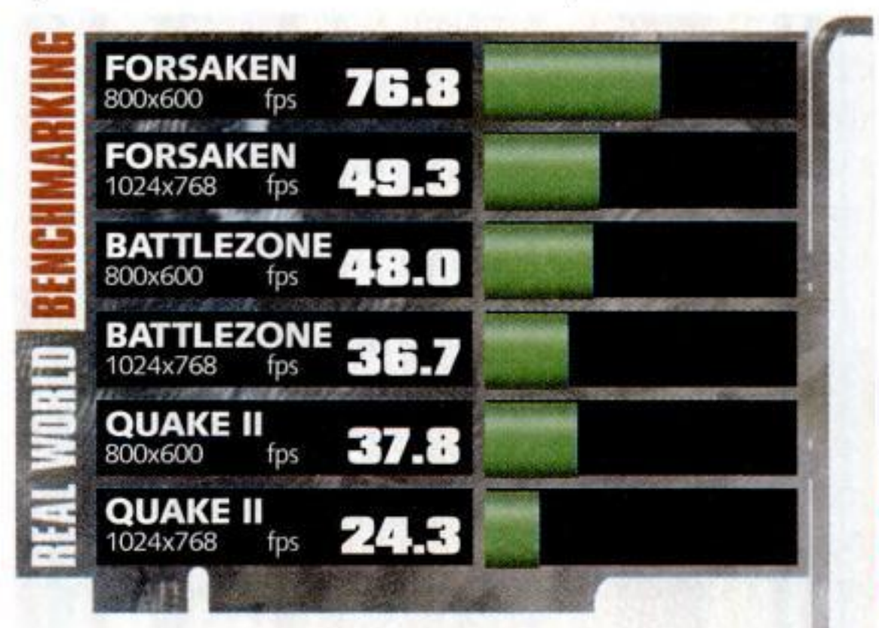
MAX 16-BIT RES/REFRESH RATE
2000x1500/160Hz

AGP?/LEVEL
Yes/1x DMA

BUNDLE
Re2Flex drivers | Win9x drivers

PLUSES
- Re2Flex allows various refresh rates and resolutions
- Glide support in a single package

MINUSES
- Not the cheapest Banshee board around
- Slightly underperforms compared with other Banshee iterations
- No OpenGL ICD
- No AGP texturing



MAXIMUM PC VERDICT

Price $149
Company Metabyte
Phone 510.494.9700
URL www.metabyte.com

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For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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Matrox Marvel G200-TV

Here's something sure to please wannabe De Milles—a videocard that does audio/video capture and playback, TV tuning, and software DVD decoding all in a single board. That's what Matrox's Marvel G200-TV does, and it throws in crystal-clear 2D and 3D to boot.

Based on the 128-bit DualBus MGA-G200 chip, the Marvel G200-TV comes with 8MB of SDRAM, which can be field-upgradable to 16MB (tested here). This is coupled to a 230MHz RAMDAC—not as big as the Millennium G200's DAC (which received a 9 Kick-Ass back in September 1998), but fast enough to render crisp 2D desktops.

Besides the standard monitor connector, a massive connector on the I/O bracket provides the interface between this AGP 2x card and the blue A/V connector box, which sits on your desktop. This box is your video-capture gateway, thanks to the devastating array of input/output connectors. In addition to the obligatory RCA and S-Video inputs, the box has coaxial antenna input. Audio outputs consist of RCA audio/video, S-Video, and a single S/PDIF connector.

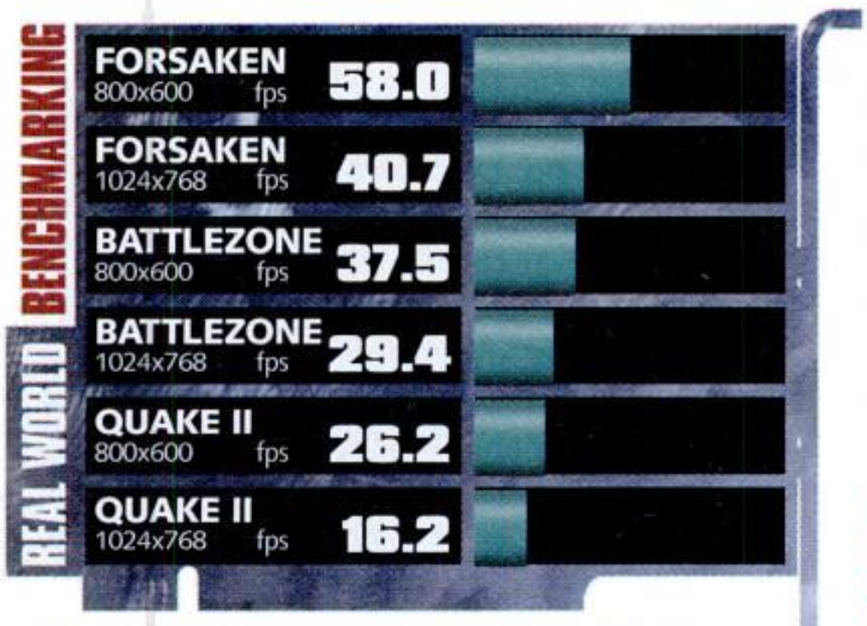
Installation was uneventful on an EIDE system, but with a SCSI board installed, the Marvel G200-TV demands IRQ 11, which resulted in major resource finagling.

As Intel found out in our September issue, six months is a lifetime for a 3D accelerator, and the Marvel G200-TV's 3D performance is showing signs of age. 60fps at 800x600 *Forsaken* is good, but not awesome, when compared with TNT's triple-digit scores. Matrox has yet to ship a final OpenGL ICD—the beta released back in December proved too unstable for testing. Regardless, the visual quality this card produces is rich under Direct3D titles, and its true-color, accurate z-buffer really shines.

While its 3D performance isn't going make the triple-digit bad boys lose any sleep, the Matrox Marvel G200-TV gives you a lot for its price.

—Andrew Sanchez

Going after ATI's All-In-Wonder crowd, Matrox's Marvel G200-TV has all the I/Os you could ever ask for.



* Used Direct3D-to-OpenGL wrapper instead of beta ICD.

THE SPECS

MAX 24-BIT RES/REFRESH RATE
1920x1080/70Hz

MAX 16-BIT RES/REFRESH RATE
1920x1080/70Hz

AGP?/LEVEL
Yes/2x

BUNDLE
Win9x, NT drivers | Avid Cinema | software DVD decoding | VDOPhone Internet trial | Photo Express 2.0 | Tonic trouble | PC-VCR | 3D game demos

MAXIMUM PC VERDICT

Price $300
Company Matrox
Phone 800.844.8305
URL www.matrox.com

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PLUSES

- Lots and lots of video I/O ports
- TV tuner
- MGA-G200 gives great looking 3D and 2D
- Comes with Avid Cinema
- AGP 2x
- 32-bit rendering and z-buffer accuracy

MINUSES

- 3D performance lags behind current 3D champion
- IRQ trouble with SCSI

STEALING S-VIDEO BEAUTY

The Marvel's video-capture capabilities are impressive—for its price. You attach your audio and video inputs to an included breakout box that fastens to the back of the Marvel. Sound is captured through your soundcard. At the highest resolution, Marvel captures full-motion video at 704x480, roughly translating to 2.4MB/sec of video to the hard drive. However, at that setting, the video looked decent, but dropped a frame here and there during playback. We got the best performance at 352x480 at 30 frames-per-second, which digitizes at 2.1MB/sec. At this resolution, it still plays out to your TV at full screen, and the quality is certainly acceptable for a card that'll costs less than $300. The hardware also includes a bundled version of *Avid Cinema*, an intuitive video editor that sells separately for $200. You can capture, storyboard, edit, add transitions, and render your project without leaving the application. Your render options include TV, CD-ROM, and Internet quality. To give you an idea of the picture quality you can expect at Internet quality, check out the AVI folder on the Maximum CD.

—Rick Popko

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Burning Sensations

Two recorders that are 24 and so much more

Take a good, long look at your CD-ROM drive and think about how cool it would be not only to read CDs lickity-split, but write to them as well. Sure, CD-Recorders are popular PC additions these days, but there's always been a speed trade-off involved in moving to CD-R that makes them ill-suited as CD-ROM replacements. Not so anymore. Sony and HP are burning new ground with two 4x24 CD-RW drives that make your CD-ROM drive look like a one-trick pony.

But platter-rattling throughput isn't the only thing these drives have going for them. The new Sony and HP burners are both ATAPI devices, which means you don't have to worry about adding a SCSI adapter to your system. You just hook up the burner to an IDE connector and start laying tracks. If you don't have an extra IDE connection, you may want to take good long look at your one-trick CD-ROM drive.

—Sean Downey

HP CD-Writer Plus 8100i

THE SPECS

INTERNAL BUFFER SIZE
1MB

INTERFACE
ATAPI

RECORDING METHODS SUPPORTED
Disc-at-Once | Track-at-Once | Multisession | Variable and Incremental Packet Writing

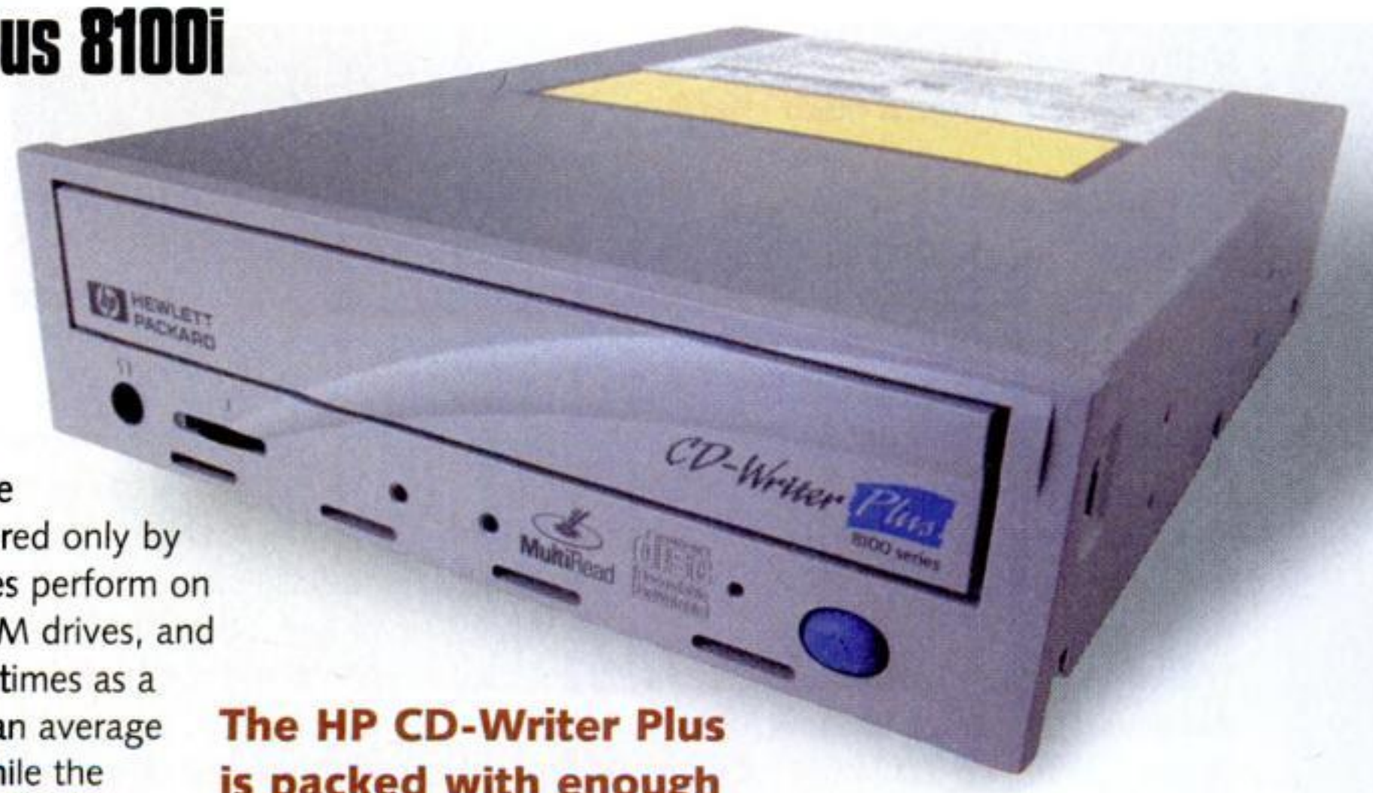
BUNDLE
Adaptec DirectCD 2.5 and Easy CD Creator 3.01 | HP Disaster Recovery | HP Simple Trax

PLUSES
- 24x read speed
- Competently handles all CD-R protocols
- Excellent software bundle

MINUSES
- CAV drive architecture

MAXIMUM PC KICK-ASS! product

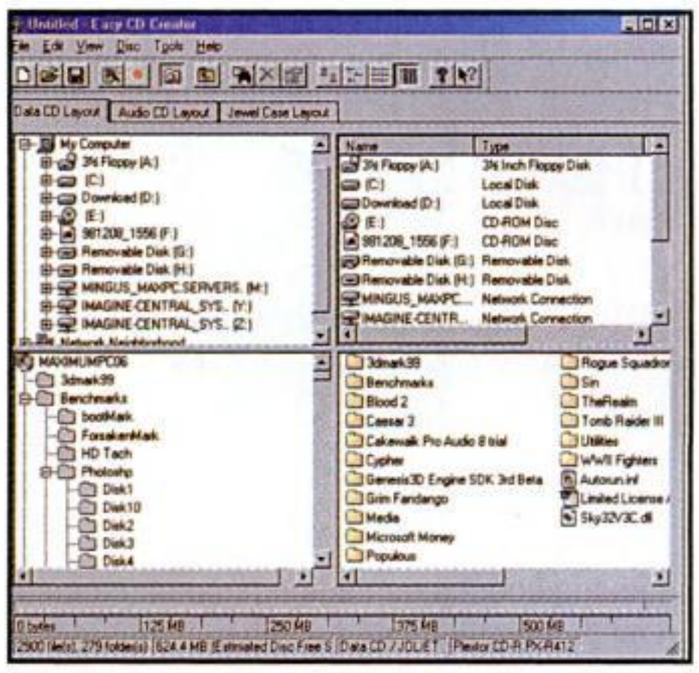
The CD-Writer Plus and the Sony Spressa posted such similar benchmarks, we wondered whether they were both built around the same drive mechanism and differed only by their faceplates. Both drives perform on par with 24x CAV CD-ROM drives, and feature exceptional access times as a result of a more nimble than average CD-R read/write head. While the Spressa notched a higher sequential read speed, the CD-Writer sports better seek times as a result of its faster moving read/write head. Besides these minor mechanical differences, what really differentiates the two drives is the software that ships with them.



The HP CD-Writer Plus is packed with enough power, brains, and nerve to guide you down the yellow brick road of CD-R gold.

Powered by Adaptec's Kick-Ass award-winning *Easy CD Creator*, the CD-Writer Plus burned through our recording benchmarks with a vengeance, besting the Spressa in all but the audio-recording tests. It performed close to its advertised write speed in our CD creation and duplication tests, posting consistent 3.7x speeds. Adaptec's *DirectCD* handled the packet writing tests with its usual competence, filling a CD-RW disc in about 26 minutes—slightly above the drive's advertised 2x rewritable rate.

The other bundled software of note is HP's *Fast Format* utility, which provides a handy new way to dump files to a blank disc without waiting for an hour-long format. The utility flash formats just enough of a disc to make it useful and then continues formatting the rest in the background. If you need to copy more than just a few small files, however, a full format is still the way to go, since the background activity greatly slows file transfers to the drive.



Easy CD Creator's combination of a phenomenally stable mastering engine and a straightforward interface makes the CD-Writer Plus want to be a better drive.

You may pooh-pooh our praise for the CD-Writer Plus 8100i because it advertises a 24x read speed, but only delivers a 16x *CD-Tach* drive rating. This has a lot to do with the drive's CAV architecture, which only kicks out the full 24x when reading from a disc's outer tracks. But even on the inner tracks, the read speed is faster than the other CD burners we've tested.

The CD-Writer Plus possesses zippy CD read/write speeds and a swanky-blue style. Along with the Sony Spressa, it posted the best benchmarks we've ever seen from a CD-R drive. With excellent features, a superior software bundle, and Kick-Ass performance, the CD-Writer is the current poster child for CD-R perfection.

MAXIMUM PC VERDICT

Price $350
Company Hewlett-Packard
Phone 888.774.6847
URL www.hp.com

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DARE TO COMPARE

	SONY	HP
Record/Rewrite/Read speed	4x/2x/24x	4x/2x/24x
Interface	ATAPI	ATAPI
Drive architecture	CAV	CAV
RECORDING BENCHMARKS[1]		
Time to copy Maximum CD disc 01 (min:sec)	20:01	19:53
Time to copy a mixed-mode disc (min:sec)	11:14	12:34
Time to create 66min. disc-at-once audio disc (min:sec)	18:37	19:58
Time to create 622MB data disc (min:sec)	21:19	19:14
Time to fill disc using packet writing (hours:min:sec)	4:05:38*	25:58
Time to format CD-RW (quick/full format) (min:sec)	0:14 35:19*	6:07 61:31
Amount of space written using packet writing (MB)	511*	529
CD TACH BENCHMARKS[2]		
Drive rating	15.7x	15.8x
Minimum sequential read (MB/sec)	1.5 (10x)	1.5 (10x)
Maximum sequential read (MB/sec)	3.5 (24x)	3.4 (23x)
Full-stroke access time (ms)	193	188
Random access time (ms)	135	135
CPU utilization	4%	4%
2K interface burst speed (MB/sec)	2.5	2.5
8K interface burst speed (MB/sec)	4.9	4.9
16K interface burst speed (MB/sec)	5.8	5.8
CD MASTERING BENCHMARKS		
CD Right! data read speed	10.4x	10.5x
Easy CD Creator transfer rate (small files) (K/sec)	384	384
Easy CD Creator transfer rate (large files) (MB/sec)	1.2	1.2
REDBOOK AUDIO EXTRACTION BENCHMARKS[3]		
CD Tach extraction speed	10.3x	9.1x
CD Tach auto alignment correction support	Yes	Yes
Extraction quality	Excellent	Excellent
REAL-WORLD COPY BENCHMARK[4]		
Time to copy contents (min:sec)	13:50	11:51

* Packet-writing tests for Sony drive were done with a beta version of Sony abCD. [1]Real world recording tests with real world data. [2]Performs a full benchmark assault on CD-ROM drives. [3]Converts CD Audio to a WAV file. [4]Time it takes to copy Maximum CD 01 to hard drive.

THE SPECS

INTERNAL BUFFER SIZE
1MB

INTERFACE
ATAPI

RECORDING METHODS SUPPORTED
Disc-at-Once | Track-at-Once | Multisession | Variable and Incremental Packet Writing

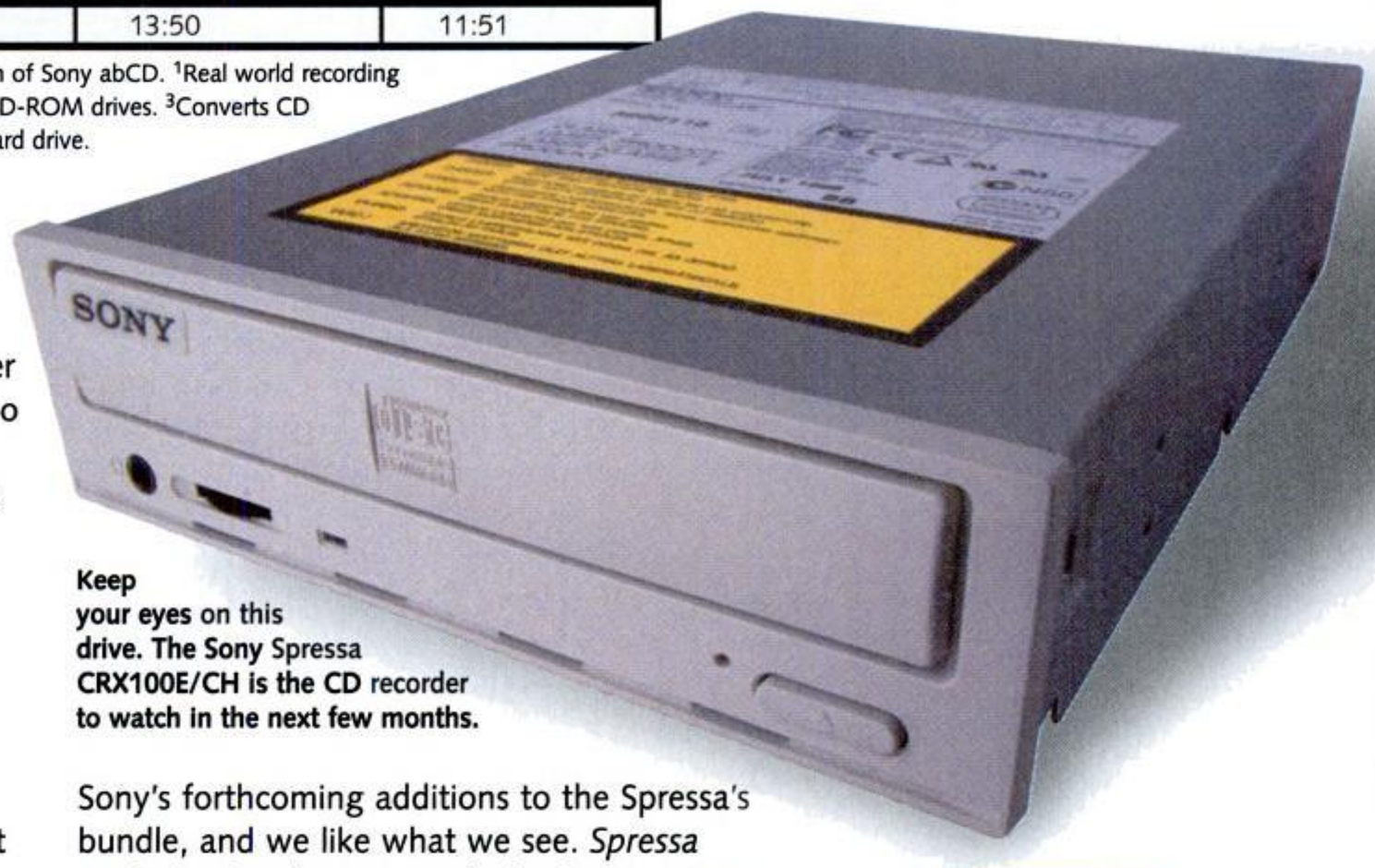
BUNDLE
Sony CD-Right! 1.5 | Sony abCD and Spressa Backup available January 1999

Sony Spressa CRX100E/CH

The Spressa CRX100E/CH has the unfortunate distinction of being a superb CD recorder at a time when a superior recorder is available. Under our benchmarks, the drive mowed through audio burns at consistent 3.5x rates and posted solid 3.3x speeds when creating and duplicating data CDs. While it bested the CD-Writer in every audio-intensive benchmark, the Spressa played catch up in our other recording benchmarks, and otherwise matched the CD-Writer Plus in our *CD-Tach* benchmarks blow for blow.

It's a shame, really, because the Spressa is a Kick-Ass drive hindered by Prassi's *CD-Right!* software, which shows a lot of potential, but just isn't in the same league, stability-wise, as *Easy CD Creator*. *CD-Right!* features several innovative features, such as a CD blocking system to keep Windows and other applications from interrupting the data flow to a CD recorder while it's writing, and a cool *CD Explorer* utility that gives you quick access to track and session information so you can easily extract files and audio tracks from complex CDs. The only problem we had during our testing came from *CD-Right!*'s fickle nature when it came to high-speed writing on a test system with networking active in the background. We were unable to achieve a reliable 4x burn until we disabled the network card.

At press time, *CD-Right!* was the only software shipping with the Spressa, but we did get to test Sony's forthcoming additions to the Spressa's bundle, and we like what we see. *Spressa Backup* takes the concept behind HP's *Disaster Recovery* software further to add selective backup and restore capabilities to the entire system-backup tools, and *abCD* is Sony's drive letter access software for CD-RW discs that works solely through UDF packet writing. Both *Backup* and *abCD* should be part of the Spressa bundle by the time you read this and will be available to all registered users.



Keep your eyes on this drive. The Sony Spressa CRX100E/CH is the CD recorder to watch in the next few months.

PLUSES
- 24x read speed
- Superior audio extraction and recording features

MINUSES
- Anemic software bundle
- CAV drive architecture

MAXIMUM PC VERDICT

Price $400
Company Sony
Phone 800.352.7669
URL www.sony.com

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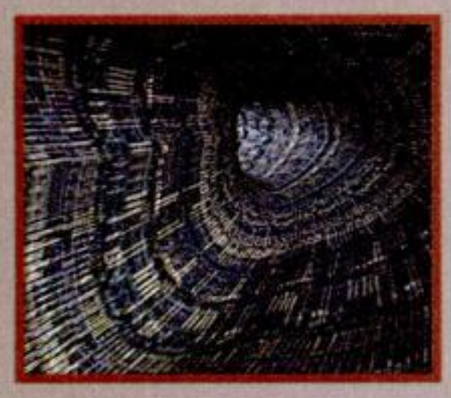
CREATE A TIME TUNNEL

Draw a curve to use as the path. At three or four points on the curve, add a profile circle and deform the control points to make it more interesting.

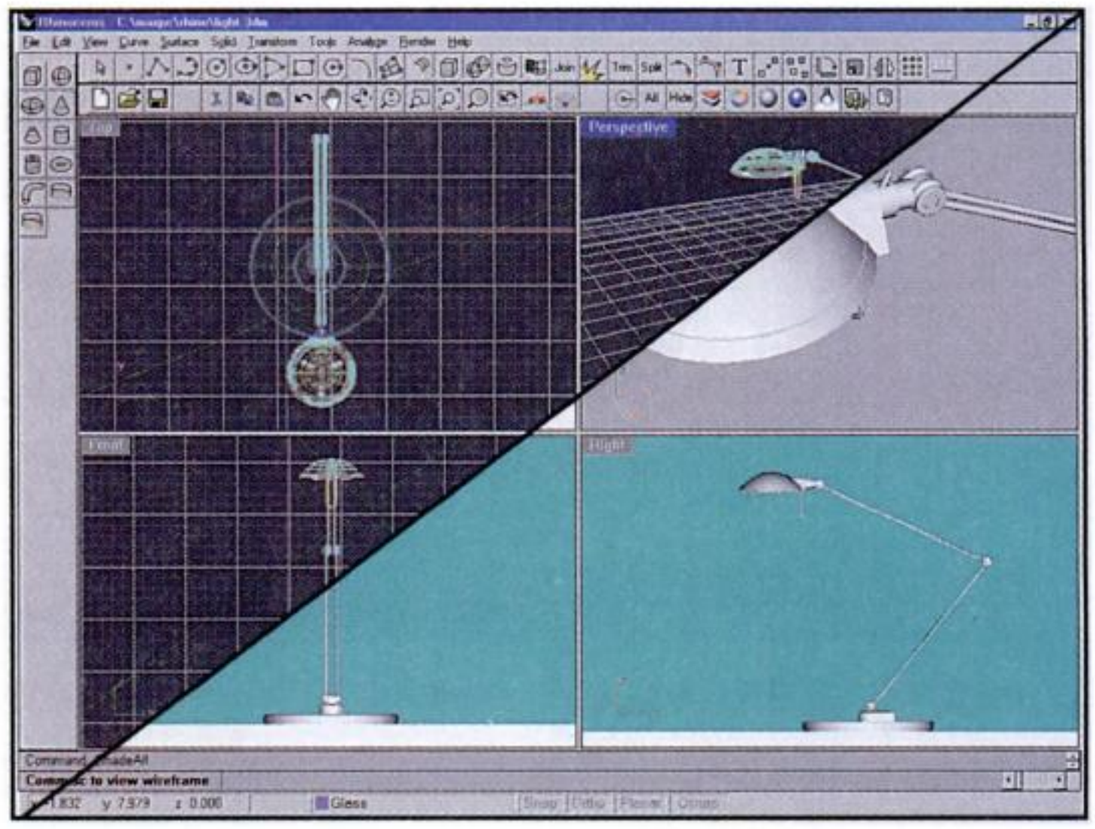
Use the birail function, sweep 1 rail: Select the rail first and then the three cross sections you created with the deformed circles. This creates the tunnel.

Change the camera lens to a wide angle, such as 25mm. Put the camera inside the tube and add texture and a light at the end of the tunnel. Save the original birail curve element, as you can use that to attach your camera to move along.



Rhino

It's one beast of a 3D modeler



Rhino lets you switch from wireframe to shaded mode, which is ideal for visualization. But when it comes to model building, you can only work in wireframe mode.

Let's face it, making certain types of 3D models with polygons can be tough. The best way to create flexible characters—or other easily deformable objects—is to use a NURBS-based modeler, and *Rhino* is one of the most affordable and feature-complete NURBS modelers around. While many high-end animation software applications require powerhouse NT workstations with dedicated OpenGL cards, *Rhino* can create just as sophisticated models on half the machine.

Within an hour we were navigating *Rhino*'s menus and viewports like a pro. But the first thing you'll want to do is change some of the defaults, such as the perspective camera lens. We chose 50mm because it gave us a better sense of depth than the default 100mm. Some of the color choices for grids, backgrounds, and so forth, were also hard on the eyes, but you have complete control over them. You can also customize the toolbars and add icons for often-used tools. One default you can't change is the world axis. *Rhino* uses z-up while many people prefer to work in y-up.

THE SPECS

FORMATS SUPPORTED

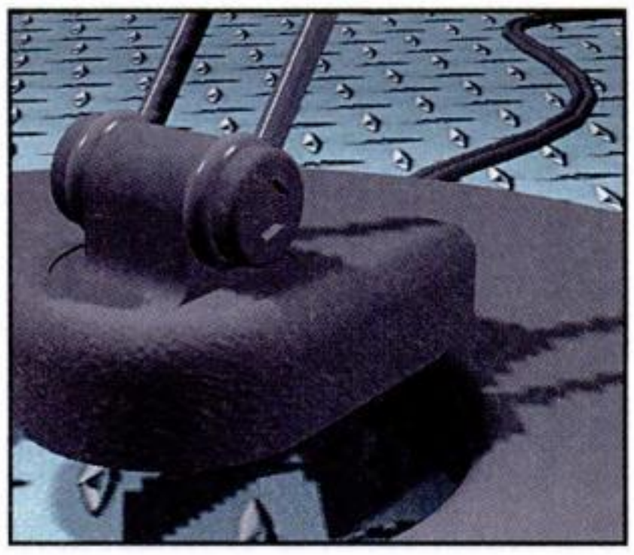
DWG, DXF, OBJ, 3DS, LWO, Raw Triangles, POV, UDO, STL, WRL, AI, EPS, WMF, RIB, AG, DXF, X, TIF

Rhino comes with loads of powerful modeling tools, such as fillets and lofting, but what we liked best about *Rhino* that many modeling applications tend to ignore is its range of primitives. For example, if you want to draw a circle, *Rhino* has eight ways of doing it, from center radius to three tangents.

Another powerful feature of *Rhino* is its complete set of surface tools for building extremely complex shapes. The birail tool sweeps a single or multiple curves along either one or two rails. This is a standard tool, but with *Rhino*, the profile curves do not have to intersect the rails, a common problem in other packages. Another timesaving feature is the pipe-creating tool. All you need to do is draw a curve, specify a start and end diameter, and *Rhino* quickly extrudes it for you.

Rhino's Booleans are fast and worked flawlessly every time. It quickly rebuilds shapes and keeps the integrity of the surface and curves. NURBS are a lot more computationally expensive than polygons, but on an nVidia TNT graphics board with 16MB of RAM, Rhino never slowed down. When moving around the viewport, much of the geometry turns off and instantly redraws once you stop. The only lag is when you're moving around in shaded mode. *Rhino* is not intended to be used for rendering, but you can place lights, and add basic materials and texture maps to get realistic images. Texture maps and bump maps are placed along the u- and v-axes and cannot be resized.

Rhino allows you to build objects in layers, but they're not easy to work with. We wanted to parent and group things easier. Objects do not have pivot points. Another huge pain is joining curves, They must be touching in order to join them, but you can select numerous curves at the same time and join them perfectly.



In this close up, you can see Booleans, revolves, and pipe surfaces.

Since *Rhino* is only a modeler, you'll need to export your creations and animate them in another package, but it supports the most common formats, including *3D Studio Max* .3ds, *Wavefront* .obj, *Autocad* .dxf and *Pixar Renderman* .rib. The manual is far from complete. If you look for something in the index, it seems as if almost everything says to "see help."

It has some flaws, but overall *Rhino* is an excellent modeler for both the beginner and expert alike.

—Alan Kennedy

PLUSES

- Full suite of tools
- Tons of primitive surfaces and curves
- Powerful Booleans
- Good tutorials

MINUSES

- Poor grouping
- Incomplete manual
- Spotlights hard to control
- Some icons are very cryptic

MAXIMUM PC VERDICT

Price $795
Company Robert McNeel & Associates
Phone 206.545.7000
URL www.rhino3d.com

8

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Analog Speakers Revisited

Tiny tunes

Not willing to chuck that A3D/EAX card for USB digital speakers just yet? Not to worry. There are plenty of regular old analog speakers awaiting your precious soundcard. Here are two that promise to bomb that bass and take minimum space.

—Andrew Sanchez

Bringing up the low-end in the S2/Midiland line, the 4030's satellites barely take up any desktop space.

S2/Midiland 4030

Recently incorporated into Midiland, S2 has decided to downscale its burly speaker line with the 4030. This three-piece neodymium magnet speaker system consists of two 3.5-inch full-range cone speakers housed in individual sealed satellites. Meanwhile a 5.25-inch woofer sits inside a vented MDF enclosure, while a 30-watt amplifier resides inside (15 watts to the bass and 7.5 watts per satellite). Dual RCA input connectors allow for a choice of input devices, while 1/8-inch mini output connectors link the satellites to the amp. 180Hz is the magical crossover point between woofer and satellites.

Rather than plopping knobs on the satellites, S2 continues to follow its design convention by including a freestanding control module that can be mounted inside a free 5.25-inch external drive bay. Resembling a car stereo pre-amplifier, this module houses master volume, bass, treble, and balance knobs, as well as buttons for input selection, mute, loudness, and S2's own sonic spatializer.

Sonically, the 4030 runs the gamut. While center staging is clear and crisp, female vocals lean toward muddiness with equalization set to center detent—boosting the treble helps. At high volumes, the satellites tend to break up due to too much bass. The subwoofer plays surprisingly flat throughout its frequency range, with bass rolling off gently from 55Hz on down. Even at 35Hz, low-frequency rumble could still be heard from the subwoofer. Just don't engage the 3DSP mode, as it adds excess hiss and distortion to your tunes. The bass and treble controls add bump and sizzle to the sounds without producing extraneous noise.

Despite the cool pre-amp and tiny satellites, the 4030's sonics fall short when compared to its beefier brethren.

MAXIMUM PC VERDICT

Price $160
Company Midiland
Phone 888.592.1168
URL www.midiland.com

6

PLUSES
- Flat bass response
- Strong center channel
- Equalization points are well chosen
- Cool pre-amplifier

MINUSES
- Sonic quality varies depending on material
- Crackling heard in satellites with big bass notes
- 3DSP induces noise

Advent Powered Partners AV390PL

These angled, sealed satellite speakers house a 3-inch midrange/1-inch tweeter combo. Handling frequencies from 80Hz on up, these are coupled to a single downward-firing 6-inch cone woofer housed in a vented box. 40 watts go to the woofer, while 15 watts go to each satellite. To take up as little space as possible, Advent allows for the subwoofer to mount against the wall, with the woofer firing into a gap created by the enclosure and wall. In effect, you'll be mass-loading the woofer, which (in theory) will give you deeper bass.

An integrated-sound spatializer can taint your tunes with either "expanded sound" or full-tilt Dolby Virtual Surround. Knobs and buttons on the right satellite adjust the master volume, spatializer mode setting, treble, and sonic contour. The woofer volume control is unfortunately placed on the woofer box.

Be careful with those DSP modes because the Advent Powered Partners AV390's sounds will change dramatically.

The system has 1/8-inch mini stereo inputs for two separate inputs and a solo headphone output jack.

Under the sonic gauntlet, the AV390 locks down a sweet center channel. But beware—the DSP modes modify sounds immensely. Non-DSP mode is flat and devoid of sparkle (sans treble boost), while the enhanced stereo adds sparkle, but pushes the center stage back. Finally, the Dolby Virtual Surround mode brings the center channel back up front at the expense of soundstage width. Tones that should be playing at extreme left or right channels are pushed more toward the center. Bass response is strong, with lots of energy around 80Hz. We encountered strain around 50Hz, but pushing the frequencies down to 30Hz didn't faze the AV390's woofer, although anything below 20Hz caused massive woofer unloading.

With the appropriate amount of tweaking, the AV390 deserve your aural attention the next time you go hunting for speakers.

MAXIMUM PC VERDICT

Price $179
Company InterAct
Phone 407.333.1392
URL www.powered partners.com

8

PLUSES
- Woofer can mount on wall
- Good bass response
- Satellites contain a midrange/tweeter
- With proper tweaking, sonics can sound sweet
- Integrated power supply in woofer box

MINUSES
- DSP modes muddle with sound placement
- Bass control on bass box

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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DragonFire

This dragon almost flies

C&F Office Machines chose some of the best add-in cards available for the DragonFire, making for one hot gaming system.

PLUSES
- Great speakers
- Great 3D performance

MINUSES
- No available PCI slots
- Had problem with hard drive power
- Sub-par DVD playback
- Poor out-of-box experience
- Weak monitor

The DragonFire Golden Elite is a custom-built gaming machine, meaning the components have been hand-picked for performance. So you generally get higher-quality components than you would with assembly-line computers. But you generally pay more and you may get a poorly integrated system. For example, instead of an organized manual with easy-to-follow instructions that take you through the entire machine, the DragonFire's component manuals are contained in a Ziploc bag.

The DragonFire is a total home entertainment/gaming solution packed with scorching 3D hardware, ear-splitting speakers, and below-average hardware DVD playback.

The 3D setup includes dual Diamond Voodoo^2 cards working in conjunction with ATI's Xpert@Play 2D card. And the DragonFire's MidiLand S2's will make your eardrums bleed.

But DVD playback, courtesy of a Creative Labs 5x DVD kit, was merely passable because the Creative card uses C-Cube's first-generation MPEG-2 decoder, whose DXR technology makes for jaggier lines (see the review in our January 1999 issue).

Amenities we truly enjoyed were Logitech's Cordless Wheel Mouse and Wingman Warrior force-feedback joystick, with both a gameport and a USB plug. The Panasonic 4x CD-R is a beautiful way both to back up your data and make copies of your... uh, stuff. But while you get Adaptec's *EZ CD Creator*, you won't find any blank media in the box.

The 19-inch monitor comes with BNC connectors and can run at up to 1600x1200 at 80Hz, but we weren't satisfied with the picture. The monitor repeatedly reverted to its default setting, causing us to manually re-input the screen image placement.

Did we mention that this machine is fast? The system didn't let us down on any of our benchmarks, tying, and—in some cases—beating the Dell Dimension 450MHz (with an nVidia 16MB TNT) reviewed in November 1998 and the JDR 400MHz (with dual Voodoo^2) reviewed in January 1999. In *Forsaken*, the DragonFire came in with 117 frames to JDR's 116 and Dell's 108, and in the OpenGL test, Dragon got a 93.5 to JDR's 83 and Dell's 57.5.

We must also mention the system locked up on us repeatedly, giving us the "Boot disk failure. Insert system disk and press enter." Luckily, we knew that meant we had a hard drive issue. Unplugging the power from the drive and plugging it back in resolved this.

The DragonFire is geared for gamers who want the best regardless of price, but we'd like to see better hardware DVD card (or software decoding) and perhaps the dual Voodoo^2's consolidated in a single card–such as Quantum's Raven3D–to free up a much-needed PCI slot.

Still, the DragonFire is a hot box that can be tailored to your taste.

—Rick Popko

UNDER THE HOOD

THE BRAINS

CPU	Intel Pentium II 450MHz
L2 Cache	512K
RAM	128MB 100MHz SDRAM (four DIMM slots, three free)
Motherboard	ASUS P2B 440BX-LS with onboard 10/100BaseT and onboard SCSI 2
Drive Bays	Three 5.25-inch (zero free), two 3.5-inch (zero free)
I/O ports	Three serial, one parallel, one composite out, two S-Video in/out, two USB, 10/100BaseT

DISPLAY

Video	ATI Expert@Play 98 AGP/2x with 8MB
Monitor	19-inch Ilyama Vision Master 450, .26 dot pitch with BNC connectors in the back
Res/Refresh	1280x1024/90Hz@32-bit

STORAGE

Hard Drive	Western Digital 10.1GB UDMA
CD/DVD	Creative Labs Encore 5x DVD/32x CD-ROM third-gen DVD kit with hardware decoding and Panasonic 4x Internal SCSI CD-Writer
Removable	Floppy
Fax/Modem	U.S. Robotics 56K Voice Faxmodem Pro

SOUND

Sound	Creative Labs Sound Blaster PCI 128
Speakers	MidiLand S2/4100 three piece

OTHER

Logitech WingMan Force joystick | Logitech wireless mouse

THE BUNDLE

Windows 98 | Battlezone | G Police | Warbirds 2.0 | Descent Freespace | Red Line Racer | Wing Commander IV (DVD version) | Incoming | Symantec Win Fax Pro 8.0

BOOT 1:30 DOWN 0:03

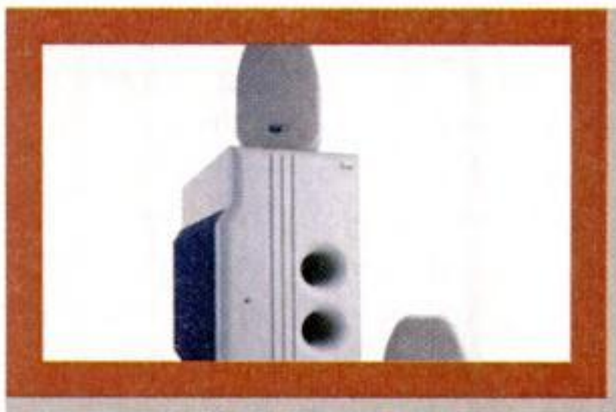
REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		209
WINDOWS APPS SYSmark 98	official score	187
HARD DRIVE HD Tach	MB/sec	11.9
CD-ROM CD Tach98	drive rating	21.5x
3D RENDERING Newtek Inspire3D	sec	480
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	67
DIRECT3D ForsakenMark	fps	117.0
OPENGL Quake2 v3.15	fps	93.5

MAXIMUM PC VERDICT

Price $4,100 with monitor, $3,600 without
Company C&F Office Machines
Phone 615.259.9588
URL www.cfoffice.com

7



Tommy Can You Hear Me? Probably not after you've cranked these things to the max. The MidiLand S2s are almost as good as a Cambridge SoundWorks setup and come with internal treble, base, and volume controls.

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EXPANSION NOTES

The DragonFire Golden Elite comes with two free ISA slots, but no free PCIs. We suggest the manufacturer either move to an all PCI motherboard, or substitute the two separate Voodoo²s for dual-Voodoo² SLI.

EXPANSION MAP

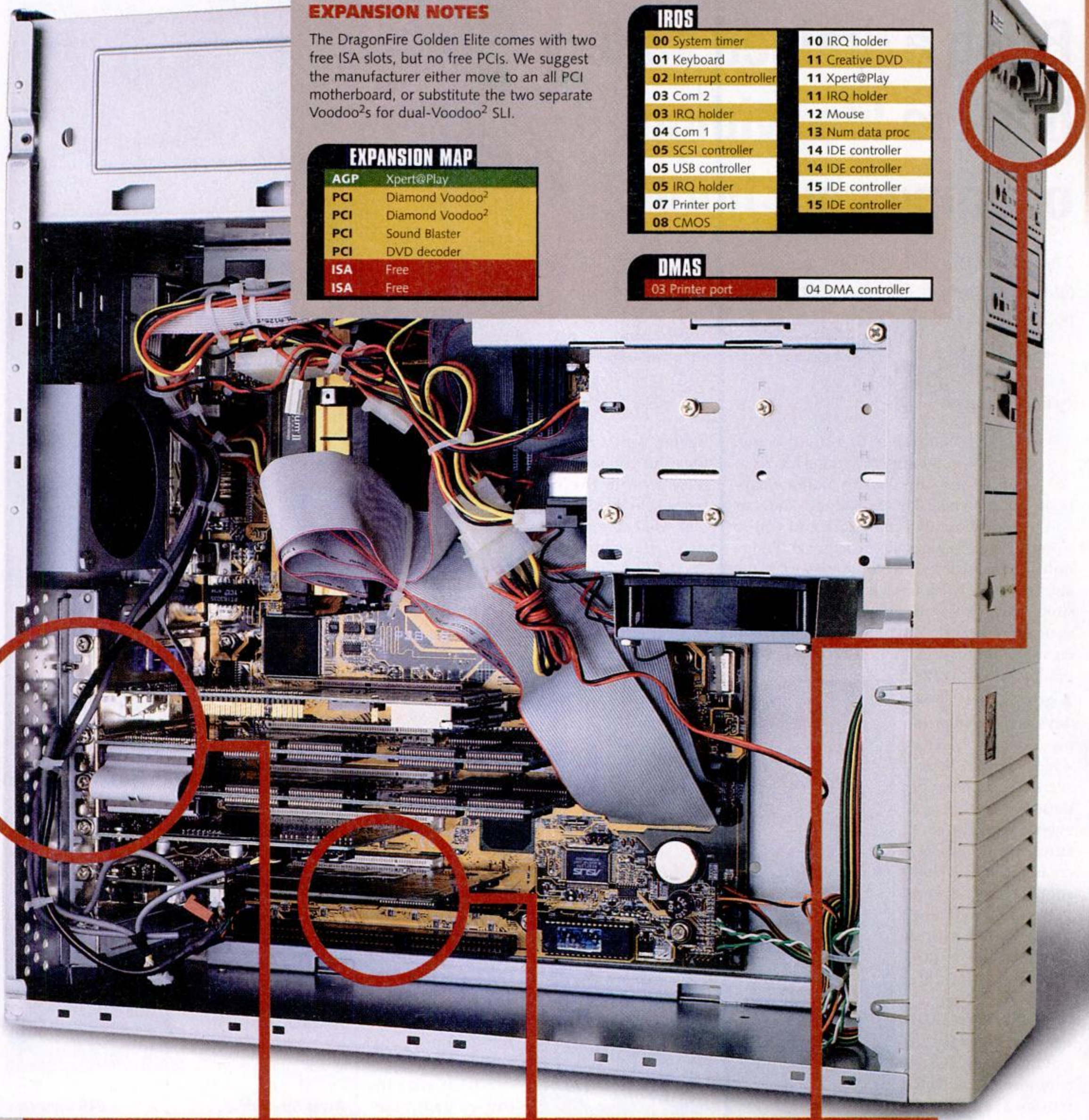
AGP	Xpert@Play
PCI	Diamond Voodoo²
PCI	Diamond Voodoo²
PCI	Sound Blaster
PCI	DVD decoder
ISA	Free
ISA	Free

IROS

00 System timer	10 IRQ holder
01 Keyboard	11 Creative DVD
02 Interrupt controller	11 Xpert@Play
03 Com 2	11 IRQ holder
03 IRQ holder	12 Mouse
04 Com 1	13 Num data proc
05 SCSI controller	14 IDE controller
05 USB controller	14 IDE controller
05 IRQ holder	15 IDE controller
07 Printer port	15 IDE controller
08 CMOS	

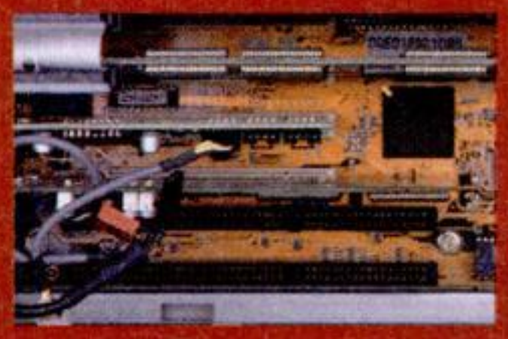
DMAS

03 Printer port	04 DMA controller



A Mouse Without a Tail The LogiTech wireless mouse made maneuvering around the desktop a pleasure. But why not throw in a wireless keyboard while you're at it?

Patch Me Through to the President Check out all the ports on this thing. The Golden Elite desperately needs an out-of-box map. It took us 25 minutes to patch all the audio and video cables.



ISA, the Dying Slot Goddess We know it's hard to let go sometimes, but when you have ISA slots in there at the expense of PCI slots, you're hurting the people who want to upgrade in the future.

Tower of Power We love this machine's goodies. The 5x DVD player flies at 21x, the CD-R is handy for data backup, and the speaker's controls let you easily tweak your audio.

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TECHNOLOGY UPDATE

Bring a drained battery back to life without opening your hood

The remarkable Auto Starter® eliminates the need for dangerous jumper cables and can provide independent power for a variety of uses.

by Chris Murdock

Imagine this...after a long flight home, you arrive at the airport parking lot, get in your car and turn the key. Nothing happens, not even a click. Guess what? Your car battery's drained. It's cold, dark and you're alone. Do you flag down a stranger and hope he has jumper cables? Do you walk back to the airport, phone a tow truck and wait? No...you simply reach into your glove box and take out your Auto Starter®. You plug it into your car's cigarette lighter and, in a matter of minutes, you're on your way.

A good start. These days, cars have complex electrical systems which support many accessories. Many of these features operate even if your car isn't running, which increases the risk that someday you'll find your car's battery drained...no horn, no lights, not even a click from the solenoid. Before Auto Starter, you either had to call a tow truck or try to get a jump from another vehicle. Tow trucks are slow to arrive and very expensive. Jumper cables, even heavy-duty ones, are dangerous and involve getting under the hood. Plus, there has to be another car around to provide the jump. Battery acid can burn your skin and ruin your clothes. If the cables are not connected correctly they can damage your car's expensive electrical system or, even worse, cause an explosion. With Auto Starter, you don't need a jump—you don't even have to open the hood. You simply plug the unit into the cigarette lighter, wait a few minutes and you're on your way. Leave the unit plugged in for 30-120 minutes while driving and it recharges automatically.

The Auto Starter eliminates the need for another car to give you a jump, and gives you a portable 12-volt DC power supply!

- *No getting out of your car*
- *No opening the hood*
- *No jumper cables*
- *No tow trucks*
- *No flagging down strangers*
- *Portable power...anywhere*

The five-amp sealed alkaline battery operates under extreme temperatures, from sub-zero to 120 degrees. It is less than eight inches long, so it stores easily in your glove box. Once it's charged, Auto Starter will retain the power to start your car for five years. It is the easiest, most convenient protection you can own.

Portable power. Auto Starter has many other uses. It's an independent 12V DC power supply that can operate TVs, radios, cellular phones and laptops. Almost any appliance that runs off of an adapter can operate independently with Auto Starter, so it's perfect for picnics, camping, boating and more.

Auto Starter also makes it easier to work on your car. Plug it in before you change the car battery, and you won't have to reprogram your car's clock, radio or alarm system. You can even use it as an emergency alternator to run your car's engine for up to one hour. You wouldn't think of driving around without a spare tire—why not have a spare battery and alternator that fits right in your glove box?

Try it risk-free. Considering the cost of a tow, Auto Starter will pay for itself the first time you have a problem. This remarkable product is backed by a one year manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. If you are not fully satisfied for any reason, return it within 30 days for a full refund, "No Questions Asked."

Auto Starter can power TVs, radios, cellular phones, laptops...you name it! Perfect for boating, camping, vacations...anywhere you need portable power.

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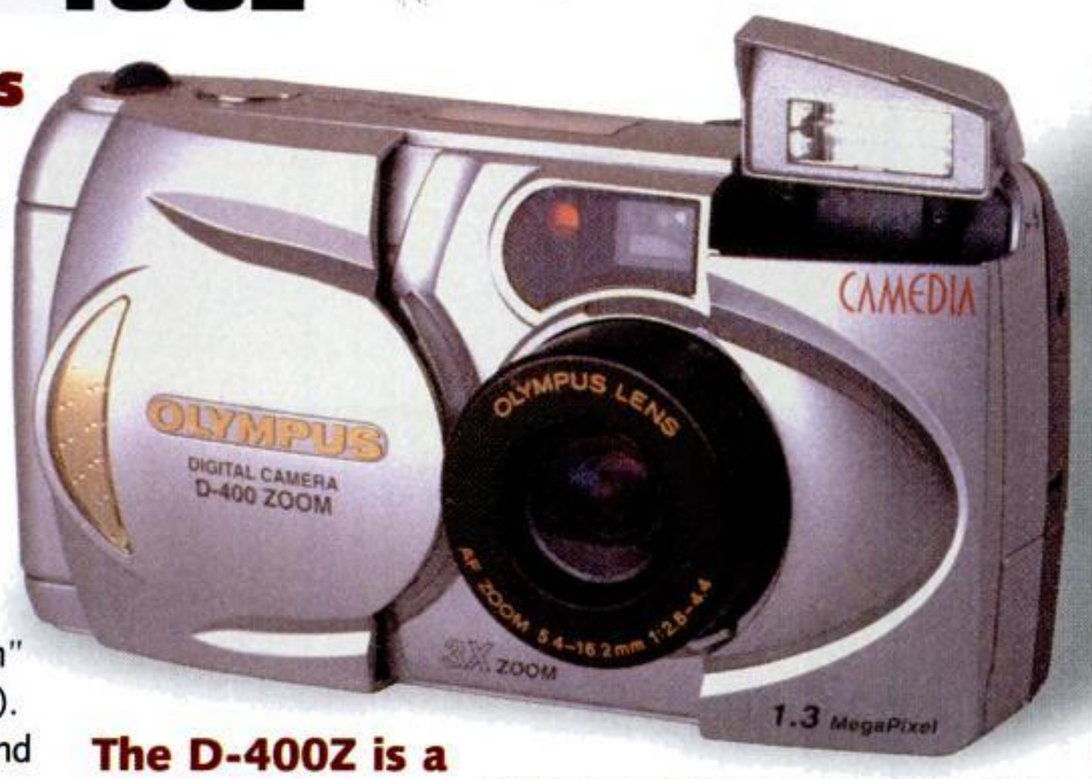
Olympus D-400Z

It shoots, it scores



The D-400Z is a sleek package that delivers superior image quality.

The D-400Z includes all the features you'd expect from the current slew of digital cameras, and then some, but falls short on execution. Thankfully, this pocketable point-and-shoot didn't sacrifice image quality, which ultimately makes or breaks a camera.

Since the disappointing D-340L (reviewed in November 1998), Olympus has added a true optical 3x zoom lens to its pathetic "digital zoom" (which really only cropped the image). The 1.3 megapixel CCD is onboard, and the Olympus tradition of exceptional image quality has been maintained. The D-400Z held its own in low light, kept colors true, and held artifacting to a relative minimum in each compression mode. The camera captures uncompressed TIFF images whose end quality is comparable to film scans, although their beefy file sizes limit the camera to two images per 8MB SmartMedia card.

Other features that make for better pictures include white balance presets that correct for the green and orange casts caused by fluorescent and tungsten lights, spot metering and focus for creative options that go beyond this camera's center-weighted cousins, and a powerful macro setting that focuses up to four inches from the lens.

But the D-400Z falls short in the details.

Burst-mode shoots up to 10 frames in half-second intervals. But the flash is disabled and the shutter speed only goes up to 1/30 of a second, so you won't get the action scenes traditional motor drives excel in. And the burst works only in low res. Since images can be captured in 2-second intervals in the standard mode (6 seconds for Super High mode), this feature isn't worth the compromises.

While it's great to have so many options, the numerous buttons on the back of the camera are labeled with frequently unclear icons. This is obviously intended to appeal to the same international audience the 200+-page manual is geared toward, but just as it's annoying to search through just the left-hand pages of the manual, these cryptic controls are counter-intuitive.

One of the "features" you can access from the myriad buttons is a zoom-in preview on the LCD, whose implementation is just plain annoying. You can't scroll around. Instead, you're restricted to the preset grid that divides the screen into horizontal and vertical thirds. If you use standard composition techniques and place your subjects on these thirds, this feature is useless.

And while the SmartMedia format is handy, the storage capacities fall far short of CompactFlash media, which now pushes 100MB (compared to the pending 16MB sizes of SmartMedia).

Like it's D-600L pro-sumer kin, the Olympus D-400Z is exceptionally power hungry. It completely consumed four AA batteries in less than two hours of testing. Even if you shoot with the power-efficient optical rangefinder, you still need to use the battery-draining LCD for most function programming.

Still, the Olympus D-400Z packs a lot into this eminently pocketable camera. The whistles and bells may hit a few flat notes, but it delivers the image quality that really counts.

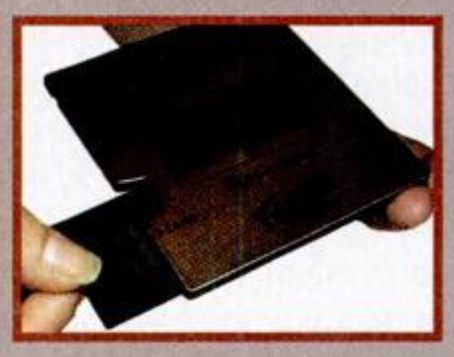
—Kristen Wilson

VISUAL QUALITY

STRAIGHT FROM THE D-400Z TO YOUR PC

1. After you've taken your pictures, close the lens barrier. Remove the card from the side of the camera.

2. Place the card in the provided FlashPath floppy adaptor then insert it into your floppy drive.



3. Drag the images from the floppy drive window to your desktop, this should take a couple of minutes.

4. Eject card from floppy drive and reinsert into camera. It's as simple as that.

THE SPECS

RESOLUTION
1280x960

REMOVABLE MEMORY
8MB SmartMedia

HI-RES IMAGES
18, plus
2 uncompressed TIFFs

VIDEO OUT
Yes

PRINTER OUTPUT
Yes

PLUSES

- Great image quality
- Uncompressed TIFFs available
- Feature-rich controls

MINUSES

- Battery hog
- Counter-intuitive controls
- SmartMedia constraints

MAXIMUM PC VERDICT

Price $799
Company Olympus
Phone 800.347.4027
URL www.olympus.com

8

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Banking | Planning | Investing | Home & Car

Financial Managers

Money, money, money, it's a rich man's world

It starts with an allowance. In time, allowance morphs into a checking account, which in turn branches into IRAs, 401(k)s, and investment portfolios. Today, instead of trying to keep track of your finances by consolidating account statements every month, we suggest checking out one of the following applications that provide tools to help make your money grow—or at least stick around a little longer.

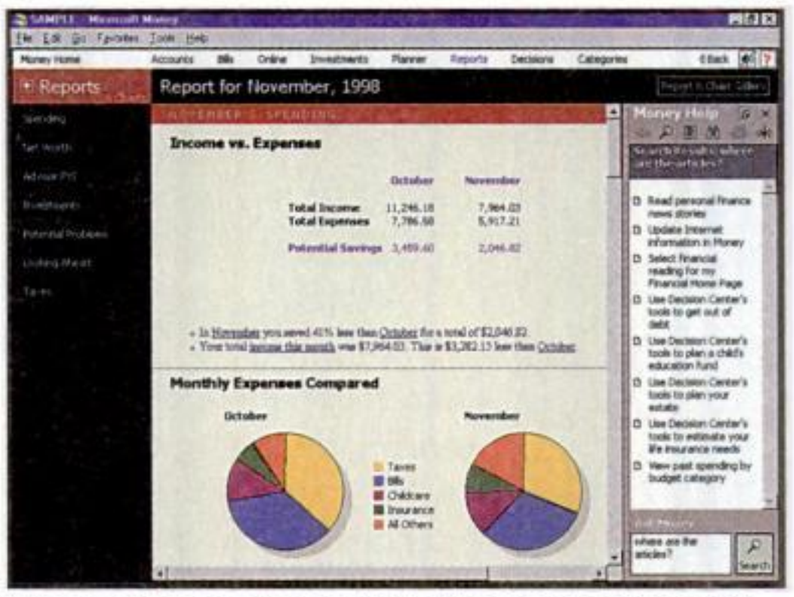
—Tara Calishain

Microsoft Money 99

Money 99 started off on the wrong foot when it rejected our version of *Internet Explorer* and insisted we install a new version.

Beyond the installation hurdle, the application is very web-like, complete with summaries of stories reachable via the web and the ability to establish online banking accounts. The web interface works as you'd expect, giving you icons for returning to *Money* and the ability to expand to a full-sized browser.

The "Financial Home Page" is customizable, allowing you to view any of several elements—bills, reminders, chart of the day, and so forth. Once you access an account, the *Internet Explorer* interface is maintained—the accounts are shown with icons, Windows Explorer style. This bothered us, but we appreciated that the accounts can also be shown as a plain list. The rest of the interface is much easier to navigate, with a help box on the right and a tabbed directory of information on the left.



The monthly report may tell you more than you want to know about your spending habits.

From the register, you can easily analyze your account activity. The Monthly Reports section is especially intriguing. A quick glance shows how your spending patterns change from month-to-month, and the supplemental charts make those numbers meaningful. If it shocks you to find out where all your money has gone, check out one of *Money*'s planners. The Debt Reduction planner shows you how paying back different amounts can balance your credit cards that much sooner. It is linear, though, and has a slight learning curve. The easy-to-use Lifetime planner does a good job of integrating your financial information into its advice.

But there's more to this application than balancing your checkbook and figuring out how you're going to pay off your credit cards. Money-driven people will appreciate the investment section, which offers teasers to many articles on the web covering different aspects of finance: choosing affordable health insurance, how to get started investing, the pros and cons of leasing a car, etc.

While Microsoft continues to improve *Money* through each permutations, we haven't yet found that "killer feature" to lure us away from *Quicken*.

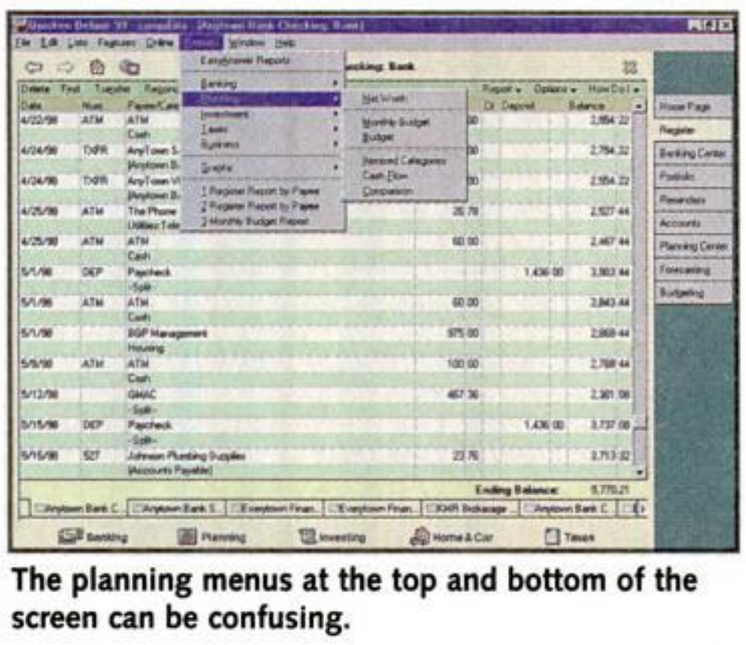
MAXIMUM PC VERDICT

Price $65
Company Microsoft
Phone 800.936.5700
URL www.microsoft.com

6

Quicken 99

In a few short years, *Quicken* has gone from a "down-home checkbook register app" to a full-blown behemoth money manager. The good news is that instead of becoming bloatware, *Quicken* has maintained a navigable interface and continued its focus on usability.



The planning menus at the top and bottom of the screen can be confusing.

Quicken starts with a "Home Page" motif, complete with home page icon and forward and back arrows. Icons across the bottom of the screen represent common banking functions, and a tab on the right takes you to your home page, checkbook register, and so forth. The bad news is that those icons are right above the web icons for the same functions, so you'll likely click on the wrong icon and go back and forth within *Quicken*, not the browser.

Quicken's interface can be overwhelming. If you want to start a new account, you might find yourself lost. There's a banking icon at the bottom of the screen and, at the top of the screen under the File menu, there's a Features/ Banking/Create New Account choice. Splitting the tasks between the menubars and icons makes things more difficult than necessary.

Once we got past the slightly confusing new-account setup, the rest of the application was a breeze. The planning screen in particular allowed us to analyze our spending habits, create budgets, forecast savings, and the like. When combined with the register, this feature gave us numerous ways to see exactly where our money was going. We liked the register setup better than *Money*'s, as we could enter checks directly into the register instead of a register form. *Quicken* also has a great feature called QuickEntry, for writing all personal checks. We spent the most time there since the majority of our financial activities deal with checking accounts.

Of course *Quicken* has an extensive connection to the web, where you can get financial features and do your online banking. A PIN vault makes it easy to remember all your financial codes.

Despite its depth and a couple of really annoying design decisions (in particular the rough transition to a web interface), *Quicken* remains an excellent program that continues to evolve.

MAXIMUM PC VERDICT

Price $60
Company Intuit
Phone 800.446.8848
URL www.intuit.com

8

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MetroBook SLT

A point-and-click adventure

With its petite footprint, lightweight design (just over 3 pounds total), built-in 56K modem, and touch-sensitive screen, you could be forgiven for thinking the MetroBook SLT was actually a Jupiter-class Windows CE device on steroids.

The MetroBook SLT actually runs Windows 98, and it's powered by a genuine—albeit lowly—Intel 200MHz Pentium MMX processor. Other signs of its PC nature are its 4GB hard drive, external floppy and CD-ROM drives, and a plethora of ports.

PLUSES
- Cute
- Lightweight
- Touch screen is cool

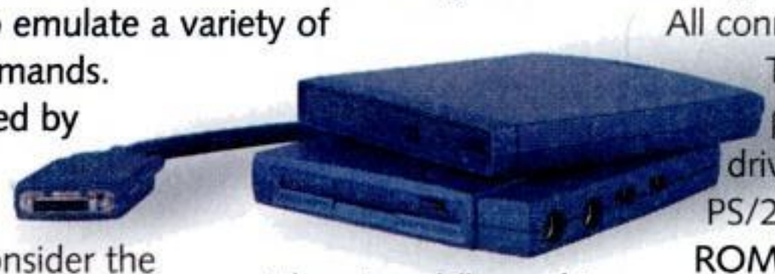
MINUSES
- No mouse
- Flimsy back panels
- USB ports only on floppy drive
- Touch screen can also be a pain

There's only one thing missing—a mouse. For that matter, there's no trackpad or pointing stick either. Instead, the MetroBook SLT is adorned with an 8.4-inch resistive-membrane touch screen and a hand-held stylus for on-screen, desktop navigation. Current PDA owners will no doubt feel at home with this setup, but if you're accustomed to a regular mouse, this unconventional interface might leave you frustrated. Mastering this newfangled navigation isn't difficult, thanks to the extensive suite of bundled handwriting and training applications.

The screen itself is anchored by two columns of icons, which have been pre-programmed to launch apps such as File Explorer or Program Manager. A quick click can also open up Notepad, start a game of Solitaire, or check the status of the battery. And all icons can be preprogrammed to your specifications. Even the touch-screen settings can be modified and set to emulate a variety of traditional mouse commands.

Before you're swayed by the MetroBook SLT's "cuteness" or "gee-whiz" touch screen, consider the applications you'll be running. With only 1MB of video memory, the MetroBook SLT isn't well suited for animations or even MPEG playback, and a 200MHz Pentium MMX isn't going to speed through spreadsheet recalculations or floating-point-intensive apps. Still, the MetroBook SLT solidly trounced Sony's VAIO 505GX (with a 266MHz Pentium) in all but one of our benchmarks, a testament to the MetroBook's solid engineering design.

The MetroBook SLT may not be the prettiest portable, but it scores points for its touch-screen interface and "tuck-under-the-arm" design.



The external floppy drive includes PS/2 and USB ports and daisy chains the CD-ROM drive.

All connectivity is done externally. The Mitsumi CD-ROM drive plugs into the external floppy drive, which also houses dual PS/2 and USB ports. The CD-ROM drive spun discs surprisingly fast—clocking in at 13.2x. We just wish the cables were longer and more flexible. The 56K modem is built-in, freeing up the two PC card slots.

It may not be as sexy as Sony's VAIO, and it lacks robust video, but the MetroBook SLT is intriguing nonetheless. But with notebooks based on mobile Celeron and K6-2 just around the corner, the budget-minded MetroBook may prove just a gimmick.

—Bryan Del Rizzo

UNDER THE HOOD

THE BRAINS	
CPU	200MHz Intel mobile Pentium MMX
RAM	64MB SDRAM (expandable to 128MB)
I/O Ports	Dual PC card, parallel, serial, external monitor, microphone-in, head phone-out, floppy/CD-ROM connector, IrDA
Modem	Built-in 56K V.90 K56Flex HSP modem
DISPLAY	
Videochip	NeoMagic MagicGraph 128ZV+ with 1MB DRAM
Display	8.4-inch TFT
Res/Refresh	800x600@16-bit
STORAGE	
Hard Drive	IBM 4GB EIDE hard drive
CD-ROM	Mitsumi 20x external
SOUND	
Sound	Yamaha OPL3-SAx wavetable/FM audio
Speakers	Single speaker
TIPPING THE SCALES	
Lap Wt	3 lbs, 8 oz
Carrying Wt	5 lbs, 4 oz

BOOT 0:53 DOWN 0:05

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark	57.7
WINDOWS APPS SYSmark 98 official score	66
HARD DRIVE HD Tach MB/sec	5.59
CD-ROM CD Tach98 drive rating	13.2x
3D RENDERING Newtek Inspire3D sec	1430
DESKTOP PUBLISHING Adobe Photoshop 5.0 sec	273
DIRECT3D ForsakenMark fps	N/A
SPREADSHEETS Microsoft Excel 97 sec	292

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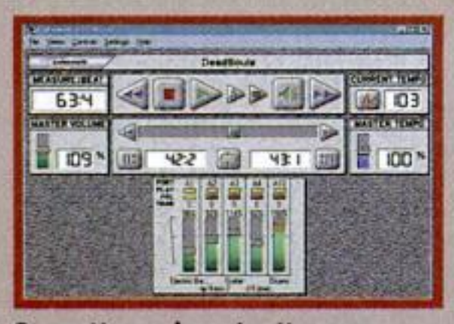
YOU CAN'T DO A THING IF YOU AIN'T GOT THAT SWING

Cakewalk's In Concert feature is supposed to simulate playing with a live band or orchestra or help a budding pianist practice their chops, but quite frankly, we were unimpressed.

Basically all this $100 application does is match the tempo and volume of any pre-made MIDI file to what you're playing style is. It doesn't load *Cakewalk*'s proprietary WRK files because they wanted it to be compatible with General MIDI files—we're told support is on the way. All the basic functions have associated icons such as Play, Stop, Loop, Goto beginning, Goto end, and something Cakewalk has lacked forever, Fast Forward and Rewind.

Important information (what there is of it, anyway) is large, clear, and on-screen at one time. For a product that's geared toward practicing or working musicians, it inexplicably doesn't show the notes you're supposed to play, and there's no playlist support either. Performances can be recorded for later manipulation in a more robust, dedicated sequencer.



Sometimes less isn't more. There should be a staff and playlist in this picture, but unfortunately In Concert doesn't support either.

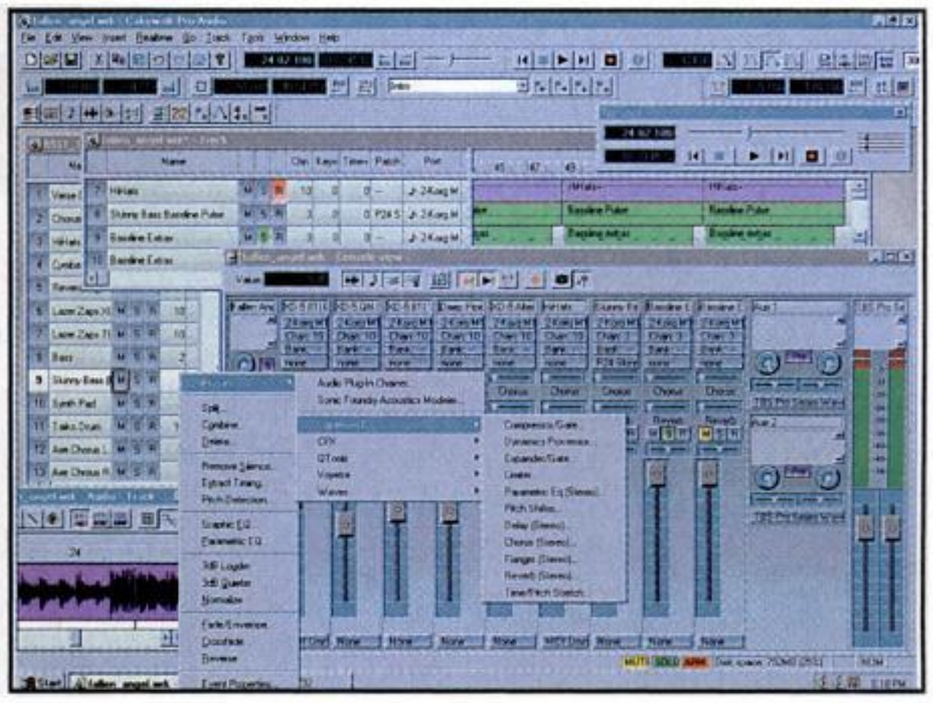
This program really wants you to be a musician to utilize its potential. Dabblers need not apply. A song book is included, as well as the associated MIDI files on a PC/Macintosh hybrid.

Cakewalk Pro Audio 8.01

A MIDI musician's dream suite

MAXIMUM PC KICK-ASS! product

Cakewalk has outdone itself again—no big surprise to hard-core MIDI musicians. *Cakewalk Pro Audio 8* now fully supports what has become the industry-standard 24-bit/96kHz sampling rate and 32-bit floating-point audio-effects processing.



In Cakewalk Pro Audio 8, multiple projects make for multiple windows. Time to get that 21-inch monitor.

This latest version incorporates a new MIDI-only effects-processing engine, which gives some "virtual" effects to MIDI events. Expansion of native support for high-end audio hardware products, a spiffed-up GUI, and a much more functional mixing console are some of the improvements in version 8.

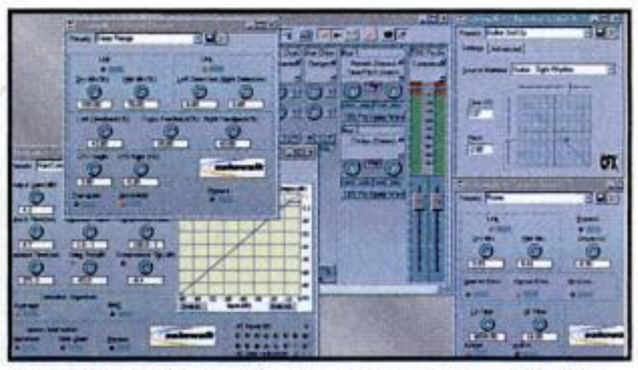
AVI, QuickTime, and MPEG video are now displayed in frames above the song with definable "anchors" on audio events.

Eagerly awaited pan and volume envelopes are graphically displayed on each clip, and event-list filtering for visually weeding out the 10 bajillion pitch-bend events from the actual notes is a huge time-saver. The patch browser, promised since version 3, allows you to search for patches containing any specified text. And a drop-down list in the record toolbar selects the modi operandi (sound-on-sound, over-write, or auto-punch).

DirectX plug-ins are no longer just for kids to amaze their friends. The two fistfuls of effects that come bundled are studio-quality and more. They retain their backward compatibility with the CFX plug-ins from previous versions, and Cakewalk allows up to 128 realtime effects across its 64 digital audio tracks, should you have a bad-ass system. This newfound power comes courtesy of a more efficient audio-mixing engine, which yields better performance under Windows NT. Consequently, independent control over the disk and wave-buffer sizes radically lowers latency. An annoying drawback, especially in a version 8 product, is the lack of realtime control over the effects parameters themselves.

PLUSES
- Cleaner interface
- Multiple projects opened at once
- 128 32-bit simultaneous effects
- Up to 24-bit/96kHz sampling
- Nondestructive audio and MIDI effects
- Video support
- MIDI Reverb and Chorus automation
- More intuitive and efficiently designed engine
- Multiple takes on multiple tracks
- Insert measures reinstated
- Improved record options
- SysEx works

MINUSES
- No automation of plug-ins



Effects are drag-and-drop and chained in the order that they appear in the boxes for each audio track, AUX1, AUX2, and Master section.

The new mixing console is arranged much more intuitively and contains both MIDI and digital audio tracks. Faders are smoother and can be grouped together for more precise control. Multiple tracks can be armed to record, while mute and solo are separate buttons so as not to affect the status of other tracks, and now there are patch points for applying effects too. Custom consoles can be saved for later recall, and many buttons have been removed or combined for a cleaner design that exploits a plethora of toolbars, right-mouse-click menus, and shortcut icons to give direct access to commonly used features.

Rounding out version 8 are improvements to SysEx dumps and cards such as the Turtle Beach Pinnacle (*CWPA6* had problems with this). Notation editing and printing include layout and spacing control, and now there are more variations on the types of staves displayed. Two features we're glad Cakewalk reinstated are the option to have a series of takes go onto separate tracks rather than stacked upon a single track and the "insert measures" command.

Those who've used *Cakewalk* for years will appreciate the new tools and features and will wonder how they got along without them. Those using a competing product will ponder this as well.

—Daevid Vincent

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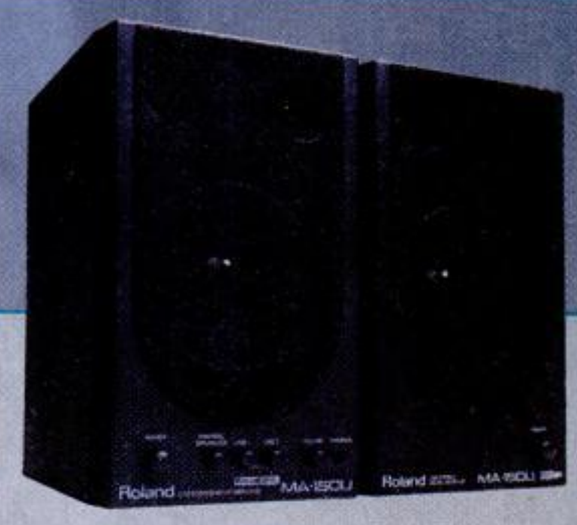

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BIOs ▶

Daevid Vincent is the former webmaster for *boot* magazine. Currently, he resides in a bunker in the Redmond, WA, area where he plots his mission to overthrow the Empire through the evangelism of Linux. He has written the soundtrack to the video game *Synnergist* and won several independent label music contests, as well as owned and operated The Matrix Recording Studio in upstate New York.

Alan Kennedy is Technical Director/ Senior Animator at Soho Post & Graphics, a Toronto-based postproduction company. Kennedy has worked in the television industry since 1979 and has been at Soho Post for the last eleven years. He is also a part-time instructor at Centennial College and the University of Toronto.

Tara Calishain has authored several books on computers and the Internet, including *Official Netscape Guide to Internet Research* and *Official Netscape Guide to Communicator, Professional Edition*. Her articles have appeared in a variety of places, including *HomePC*, *InternetWorld*, and on CINET's Gamecenter. She is the owner of CopperSky Writing and Research.

Kristen Wilson is the Production Manager at *Upside*, where she oversees the magazine's photography and digital prepress, including its current migration to the Computer-To-Press (CTP) process. Previously she held the same position at *New Media* magazine. She has a BA in photojournalism from San Francisco State University, and has won numerous awards for her striking photographs.

Tim Tully is a contributing writer for *Videography*, *EQ*, *Interactivity*, and the *New York Times*, and a producer/partner in Wild Dog Productions a independent Menlo Park–based production company that specializes in video, music, and web design. He's also authored two books: *The Audible PC* and *MIDI for the Professional*.

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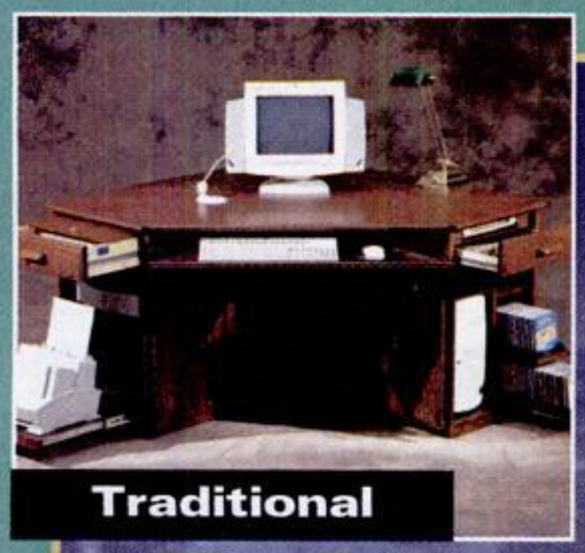

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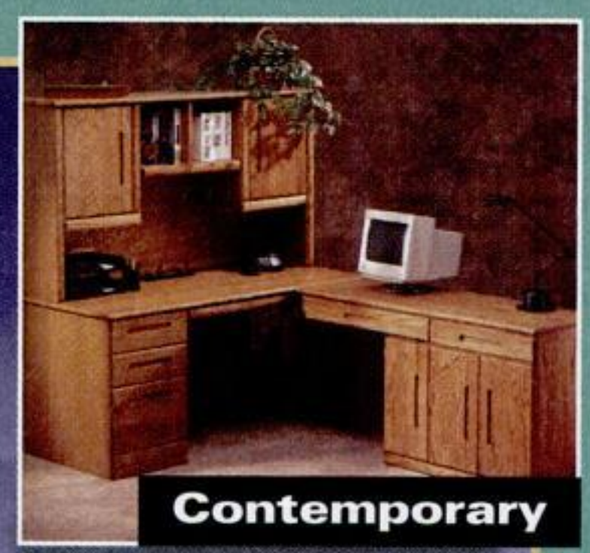

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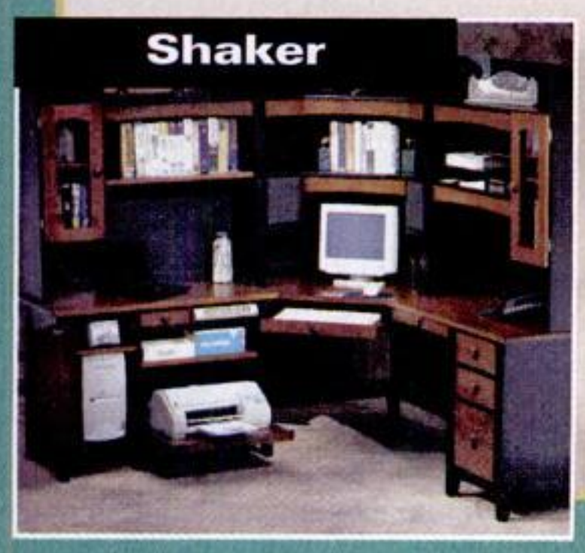
Classic Maple

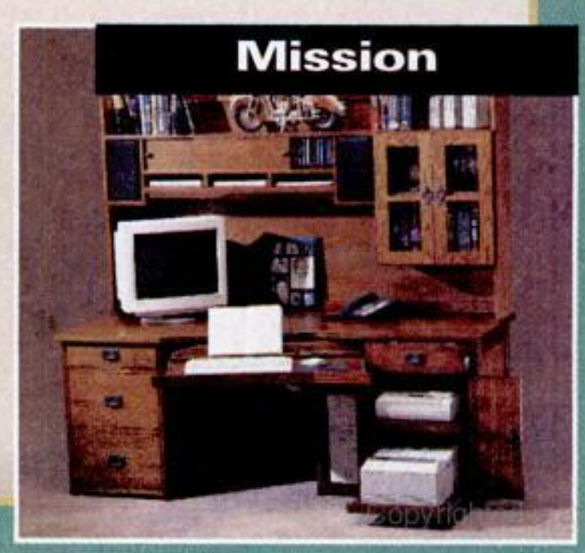
Cherry and Honey Finish on Hard Rock Maple Solids and Veneers

Cherry and Black Finish On Hardrock Maple Solids and Veneers



Shaker

Mission Cherry Finish Oak Solids and Veneers



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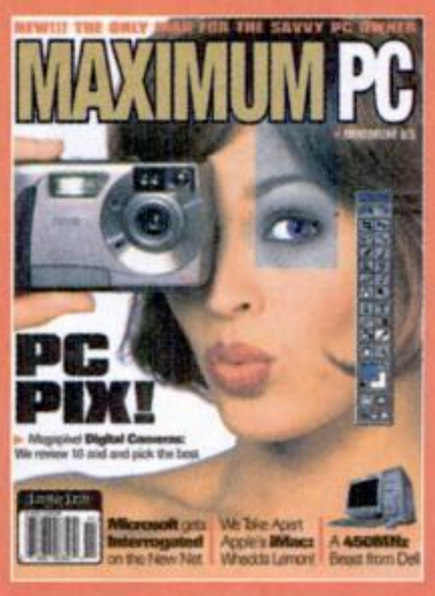

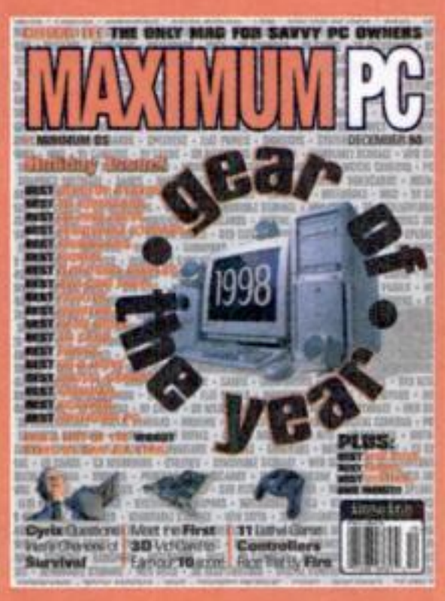

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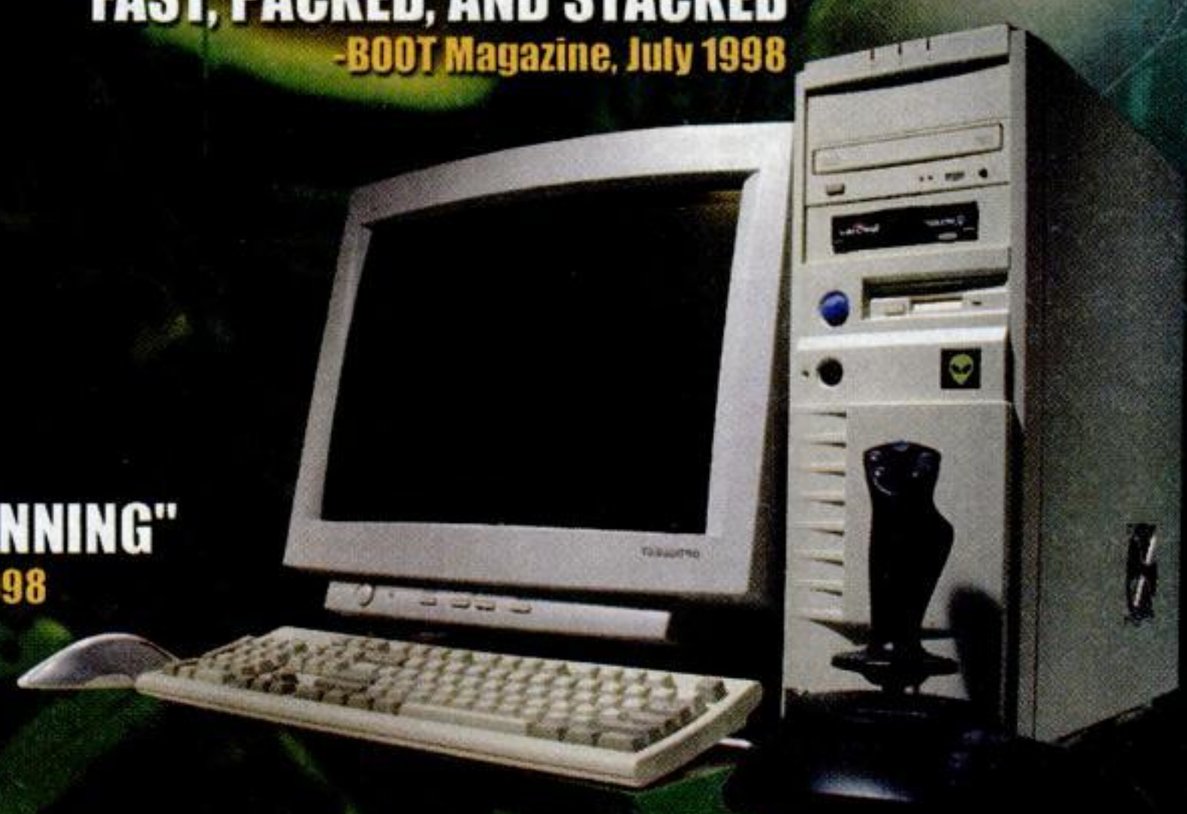

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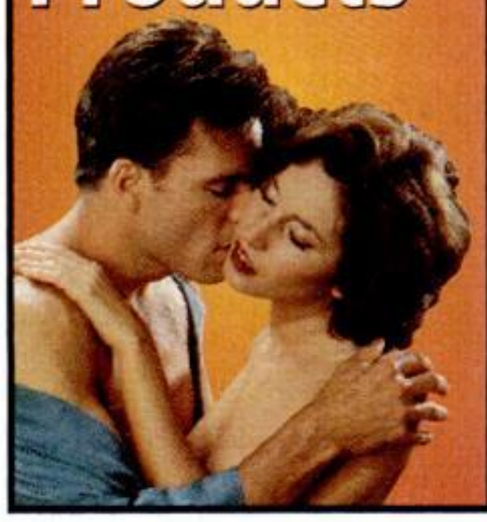

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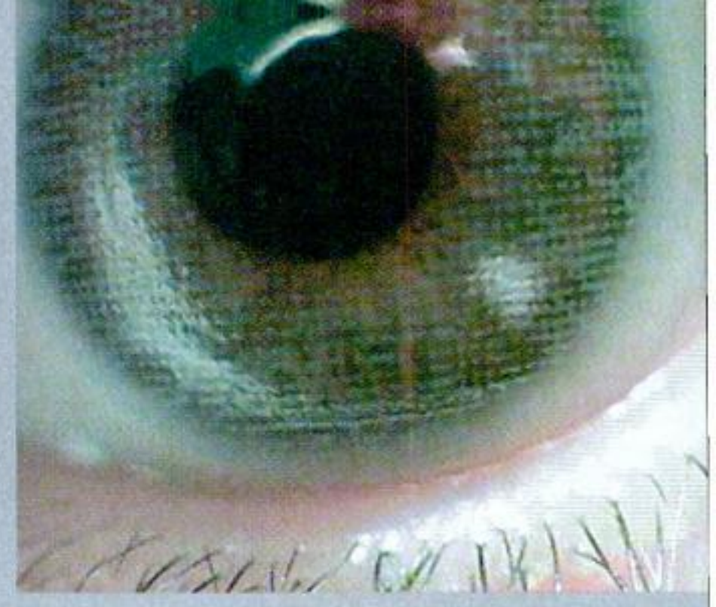

Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM PC are underlined and in blue. Hyperlink back to here for revelation and further explanation. Terms appearing in **blue** within the Terminator are updated definitions of previously explained concepts. The extended Terminator (with terms not found in this issue of the magazine) is also found online at **www.maximumpc.com**.

A

address A specific place where data is located.

AGP Accelerated Graphics Port is an expansion bus developed by Intel specifically for the videocard subsystem. It operates independent of the PCI bus and normally runs at 66MHz (i.e., 1x). Whenever you see multipliers attached to AGP, such as 2x or 4x, they are referring to how much faster the bus will run—2x means 66MHz x 2, or 133MHz.

alpha-blend The ability to give a pixel a value that will render it solid, invisible, or partially transparent. The process is often used in games to depict special effects, such as explosions and weapon discharge. When mapped onto polygons, alpha-blending can simulate semi-transparent objects, such as water and glass.

anisotropic filtering Conventional texture filtering techniques do not compensate for anisotropy—the elongation of the screen pixel when it is mapped into texture space. This results in either blurring or aliasing, depending on the choice of texture level-of-detail. To achieve sharp textures, a card can use anisotropic filtering, a process that involves an elliptical kernel whose shape and orientation depends on the projection of the destination pixel onto the texture map.

API Application programming interface. A collection of subroutines—usually part of an operating system—that application programs can call upon to perform common tasks. For example, a program might call an API routine to display a window on the screen. APIs reduce the amount of code programmers have to write.

applet A small program. The term has a special meaning in Java, referring to a program that runs inside a web browser under security restrictions that severely limit what the program can do.

application A program that serves some direct purpose for users. A word processor or a game is an application, but an operating system is considered to be system software. Programs that perform system-maintenance functions (such as antivirus checkers or disk defraggers) are often called utilities.

backside bus A special interface that connects a microprocessor to a Level 2 (L2) cache. No other system device shares the backside bus. This contrasts with the frontside bus, or system I/O (input/output) bus, which many system devices typically share. A backside bus helps eliminate performance bottlenecks.

B

BASIC Beginner's All-purpose Symbolic Instruction Code. BASIC is a programming language invented in the 1960s for teaching purposes. Since then, BASIC has evolved into a powerful language often used by professionals. Microsoft's Visual Basic is currently the most popular version.

binary code The actual program code a computer executes. Programmers write in source code, which a compiler converts into binary code (also called object code, executable code, or machine code). Binary code is specific to a particular microprocessor architecture, so a program compiled for an x86 processor won't run on a PowerPC processor or vice versa.

BIOS Basic Input/Output System. Software that contains your computer's most rudimentary instructions on how the operating system communicates with hardware. Your BIOS runs at startup, configures devices, and then boots the OS. Because the BIOS is so integral to getting your computer started, it's stored on a separate ROM chip, not your hard drive, to isolate it from crashes.

birail (or sweep) Create a surface using curves as paths (rails) for other curves to follow along.

Boolean Branch of mathematics addressing relationships between entities. In 3D modeling they are: Union (the combination of two sets), Intersection (the overlapping of two sets), and Subtraction (the part of one set remaining after an intersecting set is removed).

branch A program instruction that diverts the flow of execution along two or more alternate paths. For example, a dialog box with "OK" and "Cancel" buttons represents a branch in the program. Depending on which button the user clicks, the program will execute one path of instructions or the other.

bump maps Much like texture maps, but they give the illusion that a flat surface is distorted. For example if you used a bump map on a sphere you could get the illusion that it was an orange with many small pitted areas. As the light moves across, the bump map would make the pits look embossed.

C

C/C++ Two closely related programming languages often used by professionals for software development. C came first and is a conventional procedural-type language. C++ came later and adds object-oriented extensions.

CAV see Constant Angular Velocity

CCD Charge-Coupled Device. Sensor used in digital cameras distinguished by semiconductors connected so that the output of one serves as the input of the next.

CD-ROM cache A storage area in main system memory for frequently accessed information (it's always faster to pull data off of high-speed memory rather than slow-speed CD-ROM media).

chipset Silicon chips on the motherboard that help direct instructions from memory and the CPU and the various buses in the PC.

class library A collection of classes (object definitions) that programmers use to build object-oriented programs. Essentially, it's a prewritten code library that saves programmers from reinventing the wheel so they can develop applications more rapidly.

COBOL COmmon Business-Oriented Language. COBOL is a programming language that dates back to the 1950s and was the standard for many years on mainframe computers. Some say that most of the code still running on computers today was written in COBOL, but it has been largely superseded by modern languages.

code base The foundation or backbone of the code infrastructure.

compiler A tool that programmers use to convert their code into object code (also known as binary code, executable code, or machine code). Object code is the actual code that runs on a computer. Compilers also check for errors in source code.

Constant Angular Velocity CAV CD-ROM drives spin the disc at a constant speed, so the data rate increases as the pickup moves to the outer edges of the disc. Constant motor speed eliminates the need for settling of the optical pickup after seeking data, resulting in an improved access rate. CAV-based drives are simpler to design and produce because the motor doesn't need to change speed.

context switch An operation that's triggered when a user switches among multitasking programs. The OS must save the contents of the CPU's registers before switching to the next program, then restore the registers when the user switches back to the first program.

cross-bar An architecture within main memory that allows data to be parsed according to a specific instruction.

crossover point The point in a sine-wave signal where the strength begins to drop off due to filtering via capacitors and coils. The official point is considered when a -3dB drop starts, and continues to roll off until the signal is fully dampened. Depending on the way the filtering network is made, you can either allow frequencies past the crossover point to continue (a.k.a. a hi-pass filter), or dampen frequencies past that crossover point (a.k.a. a low-pass filter).

D

deformable Able to be bent, twisted, etc.

development tool A program that programmers use to write programs. Dev tools come in many forms, but often include a text editor (for entering source code), a compiler (for converting source code into object code), and a debugger (for finding and fixing bugs).

direct memory execution A term specific to AGP, this describes a videocard 3D chipset's ability to store textures in a computer's system memory and directly perform texture processing from this storage place. Under all other conditions, textures are first stored in your computer's system memory—when it's needed, the card grabs the texture, stores it in the videocard's local memory, then processes it. Direct memory execution bypasses the second, local-video texture-memory storage step. In effect, the videocard will treat your system memory as more local video memory, thus opening the way for massive texture storage. How much system memory is allocated for AGP textures is determined by BIOS settings.

Direct3D A subset of Microsoft's DirectX Application Program Interface. This interface allows developers to use hardware acceleration for 3D graphics, which helps games run faster by offloading the 3D processing onto a dedicated piece of hardware.

DLL Dynamic Link Library. An indispensable little nugget of software that gets deposited surreptitiously on your hard drive and makes everything melt down when it's unintentionally uninstalled.

dual-graphics-pipeline engine Refers to the number of processors of a graphics processor.

E

EIDE Enhanced Integrated Drive Electronics. A motherboard interface for connecting hard drives, CD/DVD-ROM drives, and removable storage devices.

F

FAT16 File Allocation Table 16-bit. An operating system component that tracks where data is stored on a hard drive. The 16-bit version of FAT supports drives of up to 2GB.

FAT32 File Allocation Table 32-bit. An

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operating system component that tracks where data is stored on a hard drive. The 32-bit version of FAT supports drives of up to 2TB.

fillets A new surface that is a blend between two other surfaces.

FORTRAN FORmula TRANslator. FORTRAN is a programming language invented in the 1950s for scientific and technical computing. It excels at mathematical operations and is still used today.

FP Floating point. A fractional number, such as 9.95 or 98.6. Computers have a more difficult time working with FP numbers than they do with integers (whole numbers), but the higher precision of FP is required for some operations.

FPU Floating-point unit. A function unit (collection of circuits) in a microprocessor that executes floating-point instructions.

frame An individual still image that is part of larger series of images, which form a moving picture.

frontside bus The main system I/O (input/output) interface that connects a microprocessor to other system devices. Typically, it allows the processor to communicate with main memory (RAM), the system chipset, PCI devices, the AGP card, and other peripheral buses. It also connects to the Level 2 (L2) cache unless the processor has a backside bus.

function A type of subroutine that generally returns a value when called. For instance, a function named SumAnnualSales might add up a company's sales for the year and return a dollar value to the calling program or routine. (See procedure and method.)

G

General MIDI An agreed upon specification by many synthesizer manufacturers that places the same type of timbres in the same patch location. For example a piano patch is always in patch 000. There are 128 patches allocated as well as a reverb and chorus parameter to help fatten the sound.

geometry engines Computer code that accelerates the ability to manipulate polygons in a 3D model.

geometry transformation A math-intensive process that creates the skeleton of a 3D object on a screen. It makes heavy use of floating-point numbers and matrix multiplication.

graphics pipelines The infrastructure through which graphics data is passed from the CPU to the AGP/PCI bus through the graphics card and out to the video screen.

GUI Graphical user interface. The windows, buttons, menus, scrollbars, and other graphical screen elements that allow a user to control a program. The alternate style is called a CLI (command-line interface)—users type commands at a screen prompt, as in MS-DOS.

I

image sizes A particular image resolution.

INF INFormation file. A file that contains installation information for applications and hardware.

integer A whole number, such as 1, 2, 3, etc. Computers can manipulate integers much faster and more accurately than they can manipulate floating-point numbers (fractions), but integers aren't precise enough for some operations.

ISV Independent software vendor. A developer that creates software that is not proprietary to a single manufacturer or platform.

J

Java An object-oriented programming language introduced in 1995 by Sun Microsystems with strong support for networking. Java is unusual in that it's a virtual platform as well as a language: Programs written in Java can run on many different computers without porting or recompiling.

JavaScript A web-page scripting language invented by Netscape Communications. Originally called LiveScript, it bears only a superficial resemblance to Java and is not a full-blown programming language. JavaScript is for adding functionality to HTML forms and other types of web pages.

JIT Just-in-time compiler. Often used with Java, it's a compiler that converts some form of intermediate program code into object code that a native platform can execute. The JIT compiler translates the code when the program runs—in contrast to the all-at-once approach of a regular compiler.

L

Level 2 cache The second-fastest memory available to a microprocessor (second only to the Level 1 cache). It usually consists of SRAM chips near the processor, although some recent processors have on-chip L2 caches. Also known as secondary cache.

lofting Also known as skinning. A surface is created using a series of curves as profiles.

look and feel The visual appearance and operation of a GUI. There are several styles of GUIs, such as Microsoft Windows, the Macintosh, Motif (for Unix), etc.

loop A programming structure that repeatedly executes one or more program statements a specified number of times or until a certain condition is met. Almost all programming languages have multiple loop structures designed for different purposes.

M

machine code The actual program code a computer executes. Programmers write in source code, which a compiler converts into machine code (also called object code, executable code, or binary code). Machine code is specific to a particular microprocessor architecture, so a program compiled for an x86 processor won't run on a PowerPC processor or vice versa.

main memory The silicon wafers that act as a buffer between the CPU and the hard disk.

Maximum Transmission Unit The size of the largest data packets that your machine will send over a network. If your machine sends out packets that are larger than what can be digested by the network you're working on, the packets will be broken up into smaller chunks. This can lead to slow transmission speeds as your communications software struggles to account for all the sundry fragments.

MDF (enclosure) Medium Density Fiberboard. Also known as particle board, it's a type of wood that's actually made up of wood chips glued together and pressed into workable sheets. Often used in the making of speaker enclosures due to its cheap pricing. Damages easily.

memory controller chip Silicon that controls the OpenGL API and differentiates graphics memory from main system memory.

method A subroutine in object-oriented languages. Objects have methods that perform tasks. An object named Circle might have methods named draw (which draws a circle on the screen) and fill (which fills the circle with color). The instruction Circle.draw() would call Circle's draw method. (See function and procedure.)

MIDI Musical Instrument Digital Interface. MIDI files (typically found in games or posted on web sites) trigger a set of recorded samples in your computer's soundcard and define how the samples will be played back according to pitch, tempo, and rhythm. Because MIDI files are mere triggering mechanisms, and not large, bandwidth-intensive CD-quality audio files, they can be implemented in games without suffering a performance hit. The sound of MIDI-based music is ultimately dependent on the quality of a soundcard's sample library. There are 16 MIDI "channels" for each of 16 "ports." Each channel is assigned to a particular instrument or effect, which is in turn assigned a port. Anything on the same port and channel will respond to the MIDI events that correspond.

mip-mapping Used to generate scaled texture maps by creating sub-images sized for every inverse power of two: i.e. 1/4, 1/16, 1/32, etc. The process of creating a mip-map takes time, and larger textures will require longer.

modeler 3D software module or program used to construct geometry to be used for animation.

multiple lighting engines Rendering algorithms that enhance the performance of 3D light rendering.

multiple parallel streams The ability to send and receive multiple graphic and video instructions simultaneously.

N

native code Program code that runs on a native platform. It's another term for platform-specific object code.

native platform The underlying CPU and operating system of a computer. It determines what kind of software can run on the machine.

neodymium magnet A rare earth magnet. Stronger than conventional magnets, neodymium is used in situations where you want a smaller magnet, but do not wish to give up magnetic strength. Often used in automotive speakers, neodymium has made its way into the computer desktop speaker arena.

NURBS Non-Uniform Rational B-Spline. A mathematical representation of a three-dimensional object.

O

object code The actual program code a computer executes. Programmers write in source code, which a compiler converts into object code (also called executable code, binary code, or machine code). Object code is specific to a particular microprocessor architecture, so a program compiled for an x86 processor won't run on a PowerPC processor or vice versa.

object A structure in an object-oriented program that consists of variables and methods. It's analogous to a subroutine in procedural languages.

Onyx A very expensive, proprietary computer by SGI. Onyx is used primarily by CAD developers, web servers, and special effects post-production houses.

OOP Object-oriented programming. OOP is not a programming language, but rather an approach to designing languages and programs. Object-oriented programs consist of independent modules that interact with each other in carefully defined ways. OOP is intended to speed development and improve reliability by encouraging code reuse.

OpenGL Open Graphics Language. An easy-to-use (for programmers anyway) graphics API created by Silicon Graphics. It's generally accepted in the high-end workstation market. In the Windows 9X world, OpenGL plays David to Microsoft's Direct3D Goliath or vice-versa. It's a Chevy versus Ford debate with both sides locked and loaded.

operand A numeric value or register address used by a program instruction. For example, an instruction that adds 2 and 3 might have two immediate operands (2 and 3) or the addresses of two registers that hold those values. A third operand might be the address of a register in which the CPU stores the result.

P

packet writing A method of writing data onto a CD in small increments. This is very different from Track-at-Once and Disc-at-Once methods. The packets of data written are either variable or fixed length.

PADS Sometimes a signal is too "hot," or in lay terms, loud, for the channel it's coming in on, so you "pad" the sound or attenuate it by some (usually fixed) value such as -20db or conversely "gain" it by +4db.

Pantera Nothing rocks harder.

parallelizable Refers to the problematic way that Windows NT handles multiple streams of graphic data.

parameter In programming, a value passed from one program to another, from one part of a program to another part of the same program, or from a program to an operating system. The parameter may be a number, a text string, or some other value that passes information to the receiver. Parameters are often required when calling APIs.

parent By attaching one object to another (parenting) you can create complex movement. For example, a hand is parented or joined to the forearm, the forearm parented to the upper arm, etc. By creating a parent chain you can move one object and

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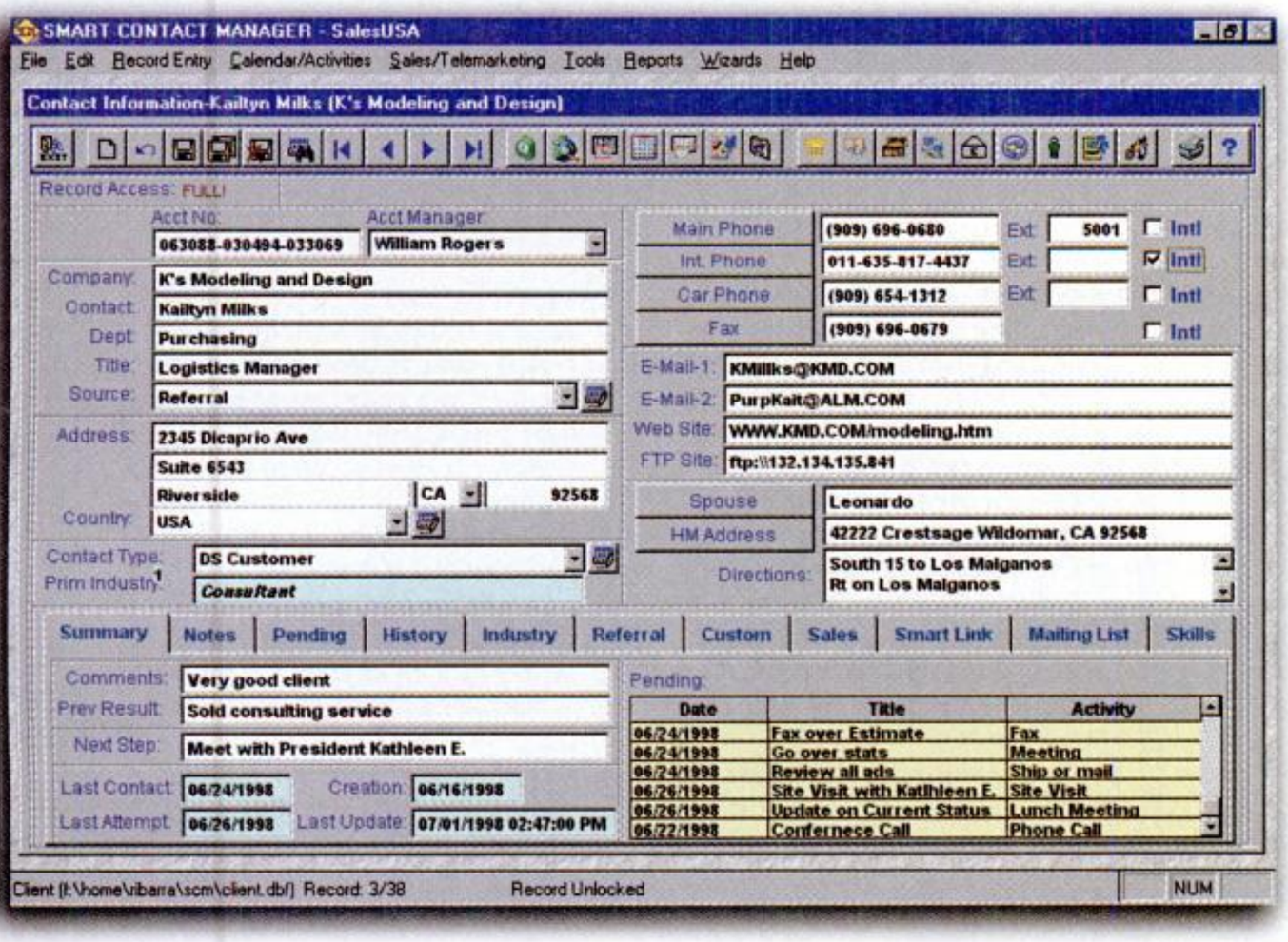

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have others follow and at the same time they can still have individual motion of their own.

parse To delete or separate.

Pascal A programming language devised in the 1970s for teaching the concepts of structured programming. It was a reaction against earlier languages that were loosely structured. Pascal has since evolved into a powerful language for professional software development.

pivot points A pivot point allows you to set the point of rotation of an object, light, camera etc.

pooh-pooh Treat with disdain, as if it's something solid and smelly that comes out of an animal's bum.

POTS Short for potentiometer. These are the little round knobs that you turn left and right. Usually used for things that have basically two states—such as a Left/Right (with that panning in between) or Quiet/Loud (such as a volume control on a stereo or old TV).

primitives Basic geometry such as a sphere, cone, or cube that you use to modify and build larger, more complex objects. Primitives help speed the modeling process because it saves you from having to build a lot of shapes from scratch, especially common shapes that will repeatedly occur in your work.

procedural language The opposite of OOP. Programs written in procedural languages tend to be monolithic, while OOP encourages the division of a program into independent modules that are reusable in future programs. The latest versions of procedural languages such as C, BASIC, and Pascal have adopted some concepts of OOP.

procedure A type of subroutine that generally does not return a value when called. A procedure named SaveFile might save a file on disk, then return control to the calling program or routine without returning a value. (See function and method.)

R

Reality-engine SGI's proprietary 3D acceleration hardware.

realtime Immediate or concurrent response. It refers to commands or actions that happen in a computer on the same time scale as in the physical world.

reference A relation, connection, or indication.

register A small storage cell in a microprocessor that temporarily holds numbers used by a running program. Usually the registers are 16, 32, or 64 bits wide. Program instructions put values in the registers, perform operations on the values, and copy the results back to memory.

Registry Windows' mass database of hardware and environmental configuration information. Think of it as Windows internal federal government—a bloated bureaucracy of software keys. Your hardware and software constantly refer to the Registry to know where to go and what to do. When the Registry corrupts, you're in for all-out anarchy.

rendering engines An algorithm that speeds rendering times of 3D objects and animation.

S

scalability The ability to upgrade a system with a secondary (or third, or fourth) processor without realizing a diminishing return on performance.

SDRAM Synchronous Dynamic Random Access Memory. A faster type of memory that synchronizes with the CPU. Its architecture allows it to run fast enough to handle the 100MHz system bus.

SGRAM Synchronous Graphics Random Access Memory. A type of single-ported memory often used for videocards that synchronizes with the CPU and uses techniques to optimize graphics processing. Considered faster than its SDRAM cousin due to its ability to perform mask writes and block writes.

SoundFont Essentially mathematical models of a sound. It isn't wavetable synthesis or FM synthesis, but rather a model of what the sound should look like in its various stages. This allows for more complex variations in the timbre in a much smaller file size. Its strengths are sounds such as horns and guitar solos where the timbre changes slightly but noticeably over time.

source code The program instructions written by programmers. Programmers use a development tool to write, compile, test, and debug their source code. The compiler turns source code into object code, which the computer executes.

spatializer An electronic algorithm that attempts to add spaciousness and a wider soundstage to sound. It usually involves boosting the treble and adding some type of echo or reverb.

subroutine A block of instructions in a program that carries out a frequently needed task. By organizing the instructions into a subroutine, programmers can call it by name whenever necessary, eliminating redundant code. Subroutines are also known as functions, procedures, subprograms, and methods.

surface tools Tool used to modify a surface in a 3D modeling application.

swap file When an application runs out of system memory, it begins using the hard dive as virtual memory to save application and document data. The hidden temporary files written to the hard drive are called swap files. Unfortunately, writing to even a SCSI hard drive is an extremely slow process compared to writing to system memory, so you always want enough system memory to meet your application and document needs.

syntax error A spelling or grammatical error in the source code of a program. Syntax errors are usually flagged by a compiler. The compiler won't convert the source code into object code until a programmer fixes the errors.

SysEx System Exclusive. A way of transmitting machine specific bytecodes to control features or parameters of a synthesizer/effects processor that don't normally fall under the MIDI specification in a general fashion. For example, via SysEx, one can dump an entire patch bank to their synthesizer before each song, effectively blessing the synth with unlimited storage capabilities.

system bus The pipe that sends data back and forth between main memory and the CPU.

T

table-based fogging Used by 3D accelerators, it's a type of fog-rendering technique. Fog is a general term representing all atmospheric effects: haze, mist, smoke, smog. When fogging is enabled, distant objects fade into the fog color. Both the fog color and the fog density (the rate at which objects fade as a function of their distance from the viewer) are programmable. Usually set by the programmer, table-based fog is where the fog table is indexed with a floating-point representation of one of the pixel's component. This fog table should consist of 64 density values, which are unsigned 8-bit quantity. A value of 0 indicates minimum density, and 255 indicates maximum density. Fog is applied after color combining and before alpha blending.

texture maps You use scanned photos or painted images to add detail to an image such as a brick texture, etc. They are applied to a surface.

texture memory Graphics memory dedicated to texture maps that are applied to 3D objects.

3DNow! 21 new instructions that speed up 3D graphics and other tasks on x86-compatible processors. Introduced in 1998 with AMD's K6-2 processor, 3DNow! also has the support of chipmakers Cyrix (National Semiconductor) and Centaur Technology (IDT). Notably missing from this loose alliance is Intel, which is introducing its own Katmai new instructions (KNI) in early 1999.

12-volt Phantom Condenser microphones require an external power source that is 12V to operate, while Dynamic mikes use a battery internally.

U

UDF Universal Disk Format. A new file system used for CDs and DVDs. It overcomes the small partition sizes of ISO-9660 while maintaining compatibility and can be read and written to on all the major operating systems. Full support for Unicode is included, allowing for all special characters and multilanguage applications. Long filename support is also supported with up to 255 ASCII characters or 127 Unicode characters. UDF also gets rid of the directory depth limitations of the older ISO-9660 technology and utilizes space far more efficiently.

Ultra DMA Ultra Direct Memory Access. The fastest IDE protocol for connecting hard drives and removable storage devices. Capable of 33Mbps throughput.

uncompressed multistream The ability to move multiple streams of uncompressed data through the graphics pipeline simultaneously.

underlined The state of having a horizontal line immediately beneath a word or phrase that denotes said word or phrase is defined in the back of Maximum PC.

Unified Memory Architecture An architecture that only moves data once into the system.

V

variable A name in a program that represents a value stored in computer memory. The variable `jan_sales` might represent the dollar amount of company sales in January. Variables can be added, subtracted, multiplied, divided, and manipulated in numerous other ways. Variable names are chosen by programmers.

vertex An end point that defines a corner point in 2D or 3D space.

viewports When you look through a camera in a 3D scene it is called a viewport. You can have multiple viewports or cameras set up to make modeling or animation easier. Standard ones are top, right, front and perspective. The first three are orthographic (no perspective).

VxD Virtual Device Driver. A Windows driver that enables nitty-gritty interaction between hardware and the operating system's base kernel.

W

WaveSynth Short for Wavetable Synthesis. It refers to your soundcard's MIDI playback capabilities. It uses digital instrument sound patches loaded in your soundcard's memory system to intepret MIDI music playback.

world axis The center of the Cartesian co-ordinate system x, y and z. It is 0,0,0.

X

x86 A microprocessor architecture invented by Intel and widely implemented by other companies. The 486, Pentium, Pentium Pro, Pentium II, Celeron, Xeon, AMD K6, Cyrix M II, and Centaur WinChip are all x86-compatible processors. The first x86 chip was the 8086 in 1978.

Y

y-up 3D geometry is build using Cartesian co-ordinates x (horizontal), y (vertical) and z (depth). Most software uses the y vector as the up direction however some use the z.

Z

z-buffer In a 3D videocard, local video memory is often used to form a frame-buffer, which stores all sorts of data required by a 3D card in order to properly render a scene onto your monitor. With the advent of texture-mapped polygons interacting in a 3D world in realtime, the need to have a buffer with which to track positioning became a necessity. A z-buffer stores the z-axis value (front to back) of a pixel on-screen—this value is compared with incoming z-value data to determine whether the pixel will be drawn or not, and how overlapping pixels will be presented. How accurate a z-buffer is dependent on how the 3D accelerator handles z-buffer calculations, and how much memory is allocated to it. Higher color-depth rendering requires more z-buffer memory, as the amount of pixel information is made larger with more color usage. It speeds up 3D gaming by not rendering the parts of a scene that are obscured by other objects.

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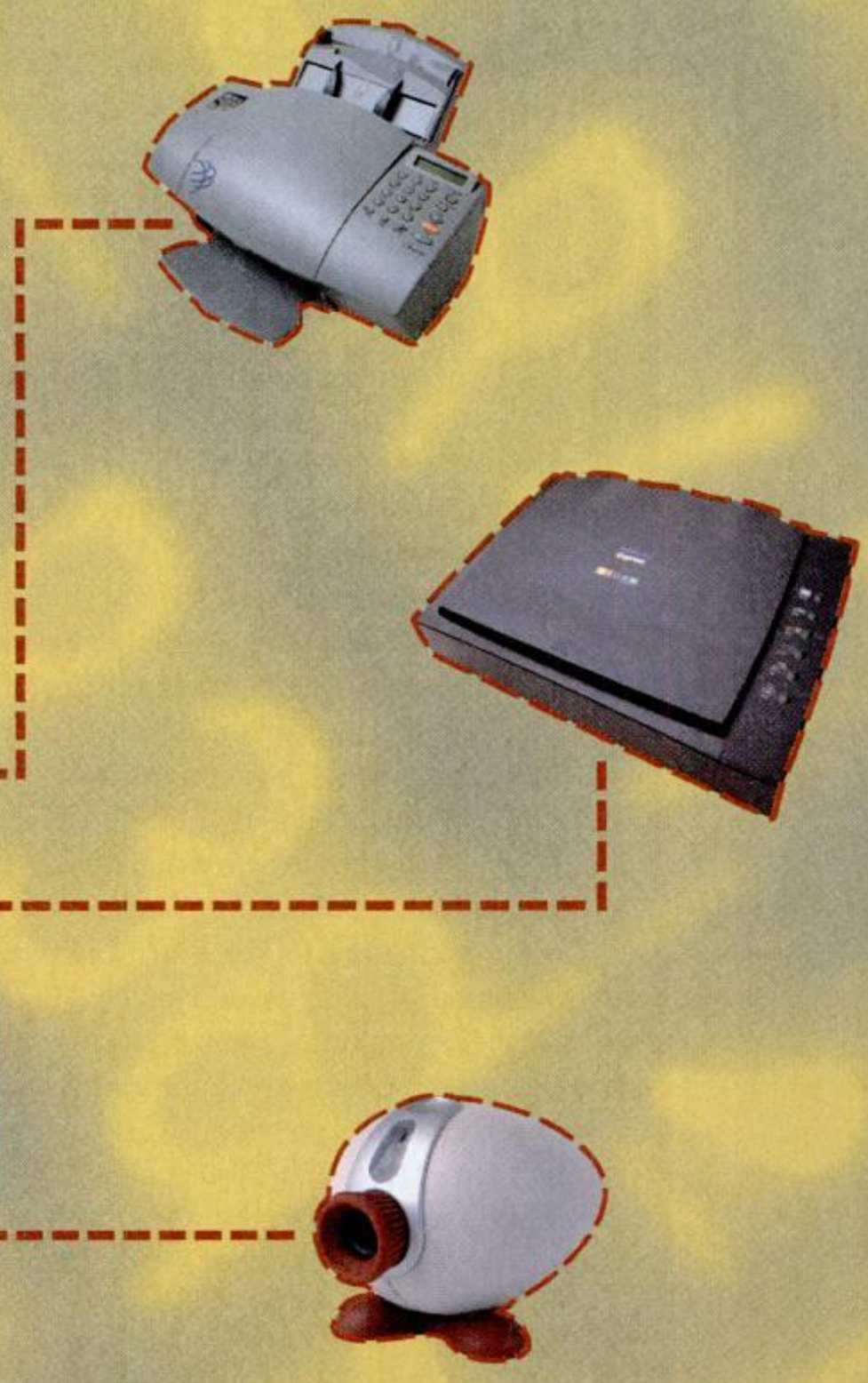

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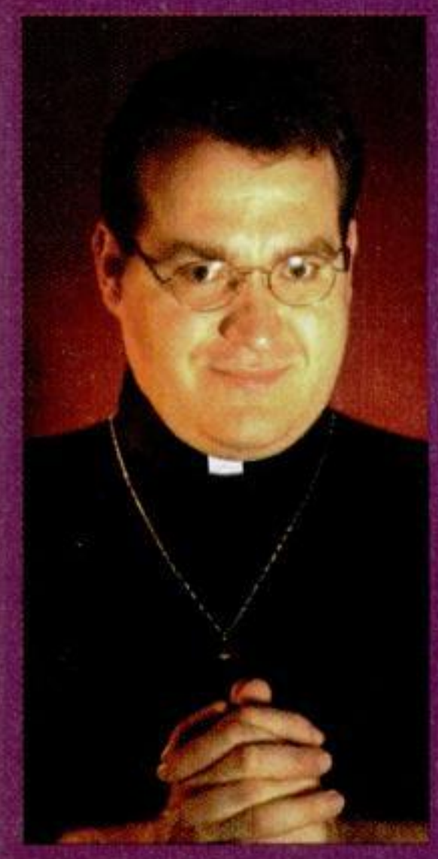

ALEX ST. JOHN was the architect of DirectX while an evangelist at Microsoft. Since leaving the empire, he has remained a player, brokering many deals in the industry. Reach him at **saint@maximumpc.com**.

Readers with "normal" lives often express skepticism when I tell stories about my more exceptional experiences at Microsoft. Nonetheless, these accounts are true to the best of my recollection. You couldn't make up these cloak-and-dagger shenanigans. With the DOJ's suit against Microsoft hitting full steam, many of these stories need to now be entered into the record of public memory, where they will be stored safely until they bear witness to the remarkable things to follow.

I was recruited from the desktop publishing industry when I was 25 to work for Microsoft's Developer Relations Group (DRG). I had no idea what job I was applying for when I was interviewed, nor did I understand what a "Technical Evangelist" did when I was offered the position. I didn't even understand how exactly I was qualified to be a "Technical Evangelist."

It took several months for me to fully grasp my mission.

As Microsoft's first publishing evangelist, I was to wrest control of the graphic arts market from Apple and Adobe. Gates wanted somebody from that world to help Microsoft dominate and displace the companies that controlled graphics at the time. I quickly learned how fierce the battle was between Microsoft and its nearest technological neighbors. I also discovered that DRG was at the heart of all of Microsoft's competitive efforts, and the job description was not something Microsoft wanted in writing.

In 1994, the year before Windows 95 was slated to be released, Microsoft was embroiled in a losing battle with Apple for leadership in the emerging multimedia market. Apple's QuickTime had successfully established a critical foothold over Microsoft's platform, and that really pissed Bill off. At the time, Windows 3.1 may not have had even 70 multimedia titles back then. All the best games were DOS-based. Microsoft needed 32-bit applications for Win95, and wanted DOS to go away, since Novell and IBM had raised effective challenges to Microsoft's dominance in that space.

The War For Windows

IN THE FOXHOLES OF MULTIMEDIA, THERE ARE NO ATHEISTS

Microsoft's approach to beating QuickTime was to try to make a superior video player, a good—if predictable—approach that might have worked if the people responsible for accomplishing this hadn't been so abysmally ineffectual.

So, DRG quietly staffed a team of nearly a dozen evangelists whose sole agenda was to run interference with Apple's technology initiatives. OpenDoc, CD Audio, video playback, authoring, and QTVR—not to mention publishing—all had full-time employees devoted to driving Apple off the Windows platform.

I asserted that if Windows ran games well, it would address all these problems in one fell swoop. Bringing games to Windows wouldn't make QuickTime go away, it would just make it irrelevant. Thus, the job of Game Evangelist was created.

In a bid to conclusively end the multimedia war with Apple, Microsoft began developing the bomb: The first GameSDK, aptly called "The Manhattan Project." This technology became DirectX.

Without an answer to DirectX, Apple could no longer claim leadership in multimedia. Windows was flooded with non-QuickTime content, and Apple lost its strategic multimedia position on Windows. Demand for DOS drained away as the game community abandoned IBM and Novell efforts. Win95 got 3,000 new 32-bit applications, and the legacy of this offensive persists. Even today, over half of all Windows applications are games.

Apple, for its part, did everything it could to resist the DirectX onslaught. There were negotiations with Microsoft to license DirectX. Apple wanted to change the APIs to support OpenDoc, but Microsoft insisted the APIs remain identical to the PC ones.

Apple sued Microsoft and Intel over source code in DirectDraw, which Apple claimed Intel had stolen. As I recall, Intel and Apple had hired the same contractor to build low-level video technology, and the contract company had re-used some code in Intel's project that they had allegedly sold to Apple.

But this ploy failed to delay DirectX. We had already rewritten all the code Intel had given us.

A year after the announcement of DirectX at the 1995 Computer Games Developer Conference, Apple announced PowerX, its family of DirectX-esque APIs to stem the evacuation of DOS and Mac developers. But it was too late. Apple was in the midst of a huge financial crisis, and as it declined, Microsoft recruited all its best multimedia executives. The battle was lost.

In a bid to conclusively end the multimedia war with Apple, Microsoft began developing the bomb: a GameSDK, aptly called "The Manhattan Project." This technology became DirectX.

QuickTime did not remain irrelevant for long, however. It found new legs on the Internet. Gates, still frustrated by the multimedia team's inability to create a better solution for video playback, would often threaten to license QuickTime from Apple if they couldn't make a better one.

But that's a story for another column. ✹

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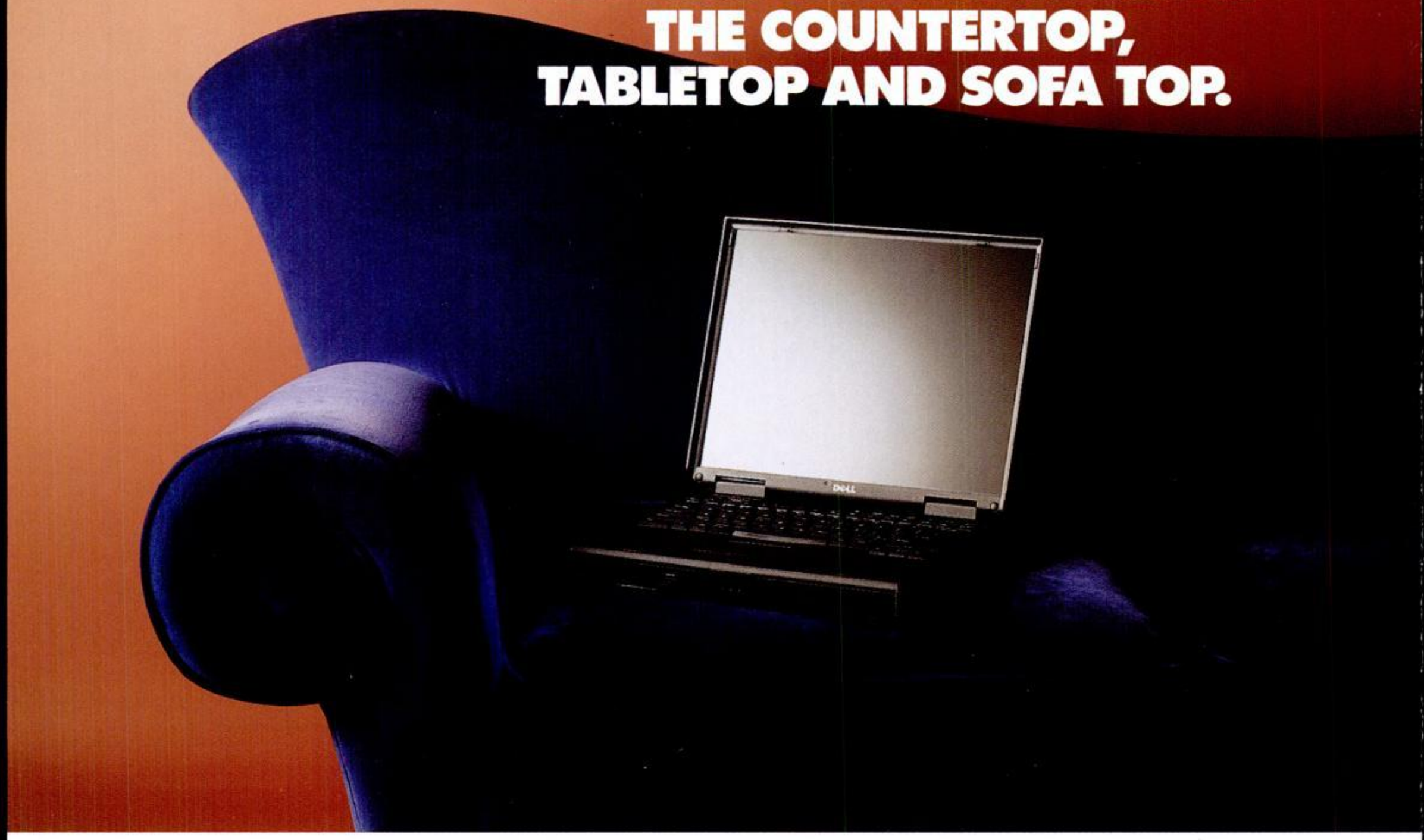

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- MS Works Suite 99 with Money 99 Basic

★ *Upgrade to 2X AGP 8MB ATI RAGE Pro 3D Video, add $39.*

★ *Upgrade to a 6.4GB Ultra ATA Hard Drive, add $149.*

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Personal Lease°: $105/Mo., 36 Mos.

E•VALUE CODE: 88607-800127

DELL INSPIRON 7000 D300LT
PENTIUM II PROCESSOR AT 300MHz

- 15" XGA Active Matrix Display
- 64MB SDRAM
- 6.4GB Ultra ATA Hard Drive
- Removable Combo 2X DVD-ROM Drive and 3.5" Floppy Drive
- 2X AGP 8MB ATI RAGE Pro 3D Video
- Internal 56K Capable™ V.90 Fax Modem
- 30-Day Trial Offer ConnectDirect Internet Access
- MS Works Suite 99 with Money 99 Basic

★ *Upgrade to 128MB SDRAM, add $199.*

★ *Inspiron Port Replicator, add $149.*

★ *Second Intelligent Lithium Ion Battery, add $129.*

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Upgrades: 3-Year Premier At-home$^{\Delta}$ Service, add $99 ◆ HP® DeskJet® 722C Color Printe

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INTEL CELERON PROCESSOR AT 333MHz

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- 8.4GB Ultra ATA Hard Drive
- 17" (15.9" viewable) 1000LS Monitor
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- 32X Max^ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- Dell QuietKey® Keyboard
- Logitech First Mouse+ Wheel
- ★ *Iomega Zip 100MB Internal Drive with Two Cartridges, add $99.*
- ★ *Upgrade to 128MB SDRAM, add $139.*
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$1299

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E•VALUE CODE: 88607-500112

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- 8.4GB Ultra ATA Hard Drive
- 17" (15.9" viewable) 1000LS Monitor
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- 40X Max≈ Variable CD-ROM Drive
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- harman/kardon HK-195 Speakers
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- Dell Comfort Key Keyboard
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$1699

Personal Lease°: $64/Mo., 36 Mos.

E•VALUE CODE: 88607-500116

DELL INSPIRON™ NOTEBOOKS

Common features for Inspiron 3500: 3D Surround Sound and Software Wavetab ◆ MS Windows 98 ◆ Touchpad ◆ 3-Year Limited Warranty† **Common features for In** Battery ◆ MS Windows 98 ◆ Touchpad ◆ 3-Year Limited Warranty† **Upgrades:** Canon E

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PENTIUM II PROCESSOR AT 233MHz

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- Modular 3.5" Floppy Drive
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- 30-Day Trial Offer ConnectDirect Internet Access
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$1999

Personal Lease°: $75/Mo., 36 Mos.

E•VALUE CODE: 88607-800119

DELL INSPIRON 7000 D266GT
PENTIUM II PROCESSOR AT 266MHz

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- 64MB SDRAM
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max^^ Variable CD-ROM and 3.5" Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- MS Office 97 Small Business Edition v2.0
- ★ *Upgrade to 2X AGP 8MB ATI RAGE Pro 3D Video, add $39.*
- ★ *Upgrade to a 6.4GB Ultra ATA Hard Drive, add $149.*
- ★ *Upgrade to an Internal 56K Capable$^{\pi}$ V.90 Fax Modem, add $59.*

$2399

Personal Lease°: $90/Mo., 36 Mos.

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